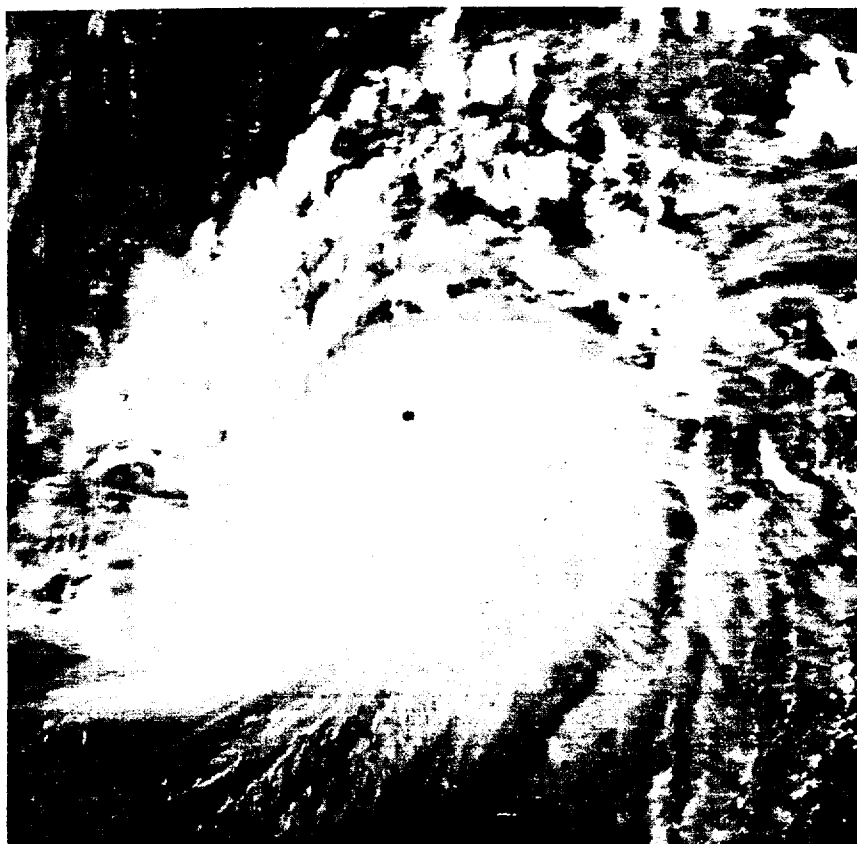


"BEST TRACK" — DEAN SPENCER

ANNUAL TYPHOON Report



Paul

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1973



FLEET WEATHER CENTRAL/JOINT TYPHOON WARNING CENTER
Guam, Mariana Islands

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1. REPORT DATE (DD-MM-YYYY) 01-01-1995		2. REPORT TYPE Annual Typhoon Report		3. DATES COVERED (FROM - TO) xx-xx-1995 to xx-xx-1995	
4. TITLE AND SUBTITLE 1973 Annual Typhoon Report Unclassified				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Buckmaster, Albert T. ; Atkinson, Gary D. ;				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME AND ADDRESS Joint Typhoon Warning Center 425 Luapele Road Pearl Harbor, HI96860-3103				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME AND ADDRESS Naval Pacific Meteorology and Oceanography Center Joining Typhoon Warning Center 425 Luapele Road Pearl Harbor, HI96860-3103				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT A PUBLIC RELEASE					
13. SUPPLEMENTARY NOTES See Also ADM001257, 2000 Annual Tropical Cyclone Report Joining Typhoon Warning Center (CD includes 1959-1999 ATCRs). Block 1 and Block 3 should be 1973.					
14. ABSTRACT The body of this annual report summarizes Western North Pacific Tropical Cyclones. Annex A summarizes tropical cyclones from 180 degrees eastward to 140 degrees west, and Annex B summarizes tropical cyclones in the Bay of Bengal. The eastern North Pacific tropical cyclone summary has been discontinued beginning with the 1973 season; the U.S. National Weather Service will assume responsibility for publication of this summary in Mariner's Weather Log and Pilot Charts.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:		17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19. NAME OF RESPONSIBLE PERSON	
		Public Release	107	Fenster, Lynn lfenster@dtic.mil	
a. REPORT	b. ABSTRACT	c. THIS PAGE		19b. TELEPHONE NUMBER	
Unclassified	Unclassified	Unclassified		International Area Code Area Code Telephone Number 703767-9007 DSN 427-9007	
				Standard Form 298 (Rev. 8-98) Prescribed by ANSI Std Z39.18	

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1973
ANNUAL TYPHOON REPORT

FOREWORD

The body of this annual report summarizes western North Pacific tropical cyclones. Annex A summarizes tropical cyclones in the central North Pacific from 180° eastward to 140°W, and Annex B summarizes tropical cyclones in the Bay of Bengal. The eastern North Pacific tropical cyclone summary has been discontinued beginning with the 1973 season; the U.S. National Weather Service will assume responsibility for publication of this summary in Mariner's Weather Log and Pilot Charts.

Fleet Weather Central/Joint Typhoon Warning Center (FLEWEACEN/JTWC), Guam has the responsibility to:

1. Provide warnings to U.S. Government agencies for all tropical cyclones north of the equator and west of 180° longitude to the coast of Asia and the Malay Peninsula;
2. Provide warnings for the area north of the equator from the Malay Peninsula west to 90°E;
3. Determine tropical cyclone reconnaissance requirements and assign priorities;
4. Conduct investigative and post-analysis programs including preparation of the Annual Typhoon Report; and
5. Conduct tropical cyclone analysis and forecasting research.

Asian Tactical Forecast Center, Fuchu (formerly Air Force Asian Weather Central), coordinating with the Naval Weather Service Environmental Detachment, Yokosuka, is designated as the alternate JTWC in case of the incapacitation of FLEWEACEN/JTWC Guam.

The JTWC is an integral part of FLEWEACEN Guam and is manned by four officers and five enlisted men each from the Navy and Air Force. The senior Air Force officer is designated as Director, JTWC.

The western North Pacific Tropical Cyclone Warning System consists of the Joint Typhoon Warning Center and the U.S. Air Force 54th Weather Reconnaissance Squadron stationed at Andersen Air Force Base, Guam.

The Central Pacific Hurricane Center, Honolulu, is responsible for the area from 180° eastward to 140°W and north of the equator. Warnings are issued in coordination with FLEWEACEN Pearl Harbor and the Air Force Central Pacific Forecast Center, Hickam Air Force Base, Hawaii.

CINCPACFLT, CINCUSARPAC, and CINCPACAF are responsible for further dissemination and, if necessary, local modification of tropical cyclone warnings to U.S. military agencies.

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CHAPTER I — OPERATIONAL PROCEDURES

1. GENERAL

Services provided by the Joint Typhoon Warning Center (JTWC) include forecasts of tropical cyclone formation, location, intensity, direction and speed of movement, and horizontal extent of critical wind speeds. This information was disseminated in 1973 by: (1) Tropical Cyclone Formation Alerts issued when formation of a tropical cyclone was anticipated; (2) Tropical Cyclone Warnings issued four times daily whenever a significant tropical cyclone was observed in the JTWC primary area; and (3) Tropical Cyclone Warnings issued twice daily whenever a significant tropical cyclone was observed in the JTWC secondary area.

FLEWEACEN Guam provides manual and computerized meteorological/oceanographic products for the JTWC. Communications support is furnished by the Nimitz Hill Message Center of the Naval Communications Station, Guam.

2. ANALYSES AND DATA SOURCES

a. FLEWEACEN GUAM ANALYSES:

(1) Surface mercator analysis, Northern and Southern Hemispheres, western Pacific and Indian Ocean areas; 0000Z, 0600Z, 1200Z, and 1800Z.

(2) Gradient streamline analysis of Asia and the western Pacific; 0000Z and 1200Z.

(3) Surface meso-analysis of the South China Sea region; 0000Z and 1200Z.

(4) Composite surface analysis of the Indian Ocean area; twice daily.

(5) Sea surface temperature charts; daily.

b. JTWC ANALYSES:

(1) Gradient level (3,000 feet) streamline analysis (south of 20°N) and isobaric analysis (north of 20°N); 0000Z and 1200Z.

(2) 700-mb and 500-mb, contour and streamline analysis; 0000Z and 1200Z.

(3) A composite upper tropospheric streamline analysis utilizing rawinsonde data from 250-mb to 150-mb and AIREPS at or above 29,000 feet; 0000Z and 1200Z.

(4) Reconnaissance data. Observations from weather reconnaissance aircraft are plotted on large-scale sectional charts.

(5) Time cross sections of selected tropical stations.

(6) Additional and more frequent sectional analyses similar to those above during periods of tropical cyclone activity.

c. SATELLITE DATA:

Satellite data, especially DMSP (formerly DAPP) satellite imagery, played a major role in the early detection of tropical cyclones in 1973. This aspect, as well as applications of satellite data to tropical cyclone tracking, is discussed in Chapter II.

d. RADAR:

Land radar reports, when available, were used for tracking tropical cyclones during the 1973 season. Once a storm moved within range of a land radar site, reports were usually received hourly. Use of radar during 1973 is treated in Chapter II.

e. COMPUTER PRODUCTS:

Use of the varian plotter by the FLEWEACEN Guam computer center during 1973 eliminated a significant portion of the JTWC hand plotting effort. Varian charts are produced routinely at synoptic times for the surface, 850-mb, 700-mb, and 500-mb levels. Additionally, a chart of the upper tropospheric circulation is produced. This chart uses 200-mb rawinsonde data and AIREPS above 33,000 feet and within six hours of the 0000Z and 1200Z synoptic times. Data not in the proper format for the computer are hand plotted on the charts. These include pibal gradient level winds, low cloud movement, and missing or late synoptic reports necessary for a detailed analysis.

In addition, the standard array of synoptic-scale computer analyses and prognostic charts from the Fleet Numerical Weather Central at Monterey, California are available.

JTWC utilized extensively the FLEWEACEN Guam computer center for objective typhoon forecasts and for statistical post analysis.

3. FORECAST AIDS

a. CLIMATOLOGY:

Various climatological publications listed in the Annual Typhoon Report, 1972 (FWC/JTWC) were utilized in addition to those received recently which include:

(1) Tropical Cyclone Climatology for the China Seas and Western Pacific from 1884 to 1970 (Royal Observatory, Hong Kong, 1972).

(2) North Pacific Tropical Cyclone Vector Mean Charts (Crutcher, H. L., 1973).

(3) North Indian Tropical Cyclone Vector Mean Charts (Crutcher, H. L. and Nicodemus, M. L., 1973).

(4) A Climatology of Typhoon and Tropical Storm Tracks Arranged by Month and Point of Origin (Ocean Data Systems, Incorporated, 1973).

(5) Tropical Cyclones of the North Indian Ocean (Sadler and Gidley, 1973) ENVPREDRSCHFAC Tech Paper No. 2-73.

(6) The Typhoon Analog Computer Program (TYFOON) described in the 1972 Typhoon Analog Program (TYFOON-72).

b. EXTRAPOLATION:

Extrapolation of storm movement using 12-hour mean speed and direction was the most reliable objective method for both 24- and 48-hour forecasts. Forecasts are determined by simple linear extrapolation using the 12-hour old best track position and the current warning position.

c. OBJECTIVE TECHNIQUES:

During 1973, the following objective forecasting methods were employed:

(1) ARAKAWA - Regression forecasts derived from surface pressure grid values.

(2) MOHATT (Modified HATRACK) - Steering by geostrophic winds derived from smoothed height fields at 850-mb and 700-mb levels modified by 12-hour history inputs.

(3) TYMOD - Program selects best steering level using global band upper air fields (GBUA) from FLENUMWEACEN Monterey modified by 12- or 24-hour history inputs.

(4) TYFOON - Analog weighted mean track.

4. FORECASTING PROCEDURES

a. TRACK FORECASTING:

An initial track based on persistence blended subjectively with climatology is developed for a 3-day period. This initial track is subjectively modified by the following:

(1) Recent steering is evaluated by considering the latest upper air analyses as representative of the average upper air flow over the past 24 hours. (The latest upper air analyses are about 12 hours old, thus roughly representing the mid-point of the last 24-hour time interval). By this technique, actual past 24-hour movement serves to indicate the best steering level as well as the effectiveness of steering.

(2) Objective techniques are considered, with the techniques being ranked according to their past performance on similar storms.

(3) Twenty-four hour height change analyses are evaluated for forecast track/speed changes (Hoover, Devices for Forecasting Movement of Hurricanes, Manuscript of U.S. Weather Bureau, 1957).

(4) The prospects of recurvature are evaluated for all westward moving storms. The basic requisites for this evaluation are accurate continuity on mid-latitude troughs and numerical progs to indicate changes in amplitude or movement. Relative position and strength of the subtropical ridge and northward tendency due

to internal forces are also important considerations.

(5) Finally, a check is made against climatology to ascertain the likelihood of the forecast. If the forecast track is climatologically unusual, a reappraisal of the forecast rationale is conducted and adjustment made if warranted.

b. INTENSITY FORECASTING:

For intensity forecasting, heavy reliance is placed on short term trends, climatology, and the satellite interpretation model developed by Mr. Vernon Dvorak of the National Environmental Satellite Service. After these initial inputs, further factors considered are upper tropospheric evacuation and possible terrain influence.

5. WARNINGS

Tropical cyclone warnings are numbered sequentially. If warnings are discontinued and the storm reintensifies, as Typhoons Dot, Ellen, and Patsy did this year, warnings are numbered consecutively from the last warning issued. Amended or corrected warnings are given the same number as the warnings they modify plus a sequential alphabetical designator to indicate it is an amended warning. Forecast positions are issued at 0000Z, 0600Z, 1200Z, and 1800Z. The forecast periods are 12-hr and 24-hr for tropical depressions and 12-hr, 24-hr, 48-hr, and 72-hr for typhoons and tropical storms.

Forecast periods are stated with respect to warning time. Thus, a 24-hour forecast verified 26 1/2 hour after the aircraft fix data, 30 hours after the latest surface synoptic chart, and 30 or 36 hours after the latest upper air charts.

Warning forecast positions are verified against the corresponding post analysis "best track" positions. A summary of results from 1973 is presented in Chapter V.

6. PROGNOSTIC REASONING MESSAGE

Whenever warnings on typhoons and tropical storms are being issued, a prognostic reasoning message is released at 0000Z and 1200Z. This message is intended to provide the field meteorologist with the reasoning behind the latest JTWC forecasts.

7. TROPICAL WEATHER SUMMARY

This message is issued daily from 1 May through 31 December and otherwise when tropical cyclone formation is forecast or observed. It is issued at 0600Z and describes the location, intensity, and likelihood of development of all tropical low pressure areas including upper tropospheric lows and significant cloud masses detected by satellite.

8. TROPICAL CYCLONE FORMATION ALERT

Alerts are issued when the formation of a tropical cyclone is anticipated. These messages are issued as required and are valid for up to 24 hours unless cancelled, superseded, or extended.

CHAPTER II — RECONNAISSANCE & COMMUNICATION

1. GENERAL

The Tropical Cyclone Warning Service depends on reconnaissance to fix the location and determine the intensity of tropical cyclones. Due to the vastness of the warning area and the scarcity of reporting stations, land and ship reports are not sufficient for these determinations. In the past, aircraft reconnaissance was used almost exclusively to determine position and intensity. With the increasing satellite capability during the last several years, satellite derived data have assumed greater importance. During the past season Defense Meteorological Satellite Program (DMSP) data were used for positioning and intensity estimates approximately one-fourth of the time.

2. RECONNAISSANCE RESPONSIBILITY AND SCHEDULING

Aircraft weather reconnaissance is performed in the JTWC area of responsibility by the 54th Weather Reconnaissance Squadron (54 WRS). The squadron, equipped with nine WC-130 aircraft, is located at Andersen Air Force Base, Guam. The JTWC reconnaissance requirements are sent daily to the Tropical Cyclone Reconnaissance Coordinator. These requirements include areas to be investigated, forecast position of cyclones to be fixed, and standard synoptic tracks to be flown.

Four fixes per day, at six-hourly intervals, are required (CINCPACINST 3140.1L) on all significant tropical cyclones in the JTWC primary area of responsibility (see inside front cover). Two fixes per day are required in the secondary area. During the past season, extensive use was made of the Selective Reconnaissance Program (SRP) to fulfill these requirements.

The SRP was implemented in 1972 to alleviate pressure on overtaxed aircraft reconnaissance assets. The SRP attempts to optimize the entire reconnaissance system by using each reconnaissance platform (aircraft, satellite, and surface radar) under optimum conditions whenever possible. Various factors are considered in selecting which reconnaissance platform to use for any warning, e.g., the cyclone's location and stage of development, the DMSP satellite times and areal coverage, availability of land radar reports, the cyclone's threat to specific U.S. interests, aircraft operational limitations (e.g., one fix versus two fix missions), etc.

Aircraft reconnaissance continues to be the best method for determining tropical cyclone position, intensity, and structure (i.e., radius of wind speeds of various intensities). Only the aircraft can provide direct measurements of height, temperature, and wind at flight altitude, sea level pressure, and other parameters. The aircraft also provides much greater flexibility in time and space compared to the other platforms. DMSP satellites provide day and night coverage of the JTWC area of responsibility. DMSP satellite imagery provides

estimates of cyclone positions and, for day-time passes, estimates of intensities using the Dvorak technique (NOAA TECHNICAL MEMORANDUM, NESS-45). In addition, satellite data used in conjunction with conventional data can provide estimates of the radii of various wind speeds. The primary disadvantages of satellites is that the coverage is often not timely for warning purposes and the satellite provides no direct measurements of parameters closely related to tropical cyclone intensity. Land radar provides useful positioning data when tropical cyclones are located near the Republic of the Philippines, Hong Kong, Taiwan, or Japan (including the Ryukyus or other islands). It does not, however, provide measurements or estimates of tropical cyclone intensity or structure. The following sections summarize the JTWC utilization of the various reconnaissance platforms during 1973.

3. AIRCRAFT RECONNAISSANCE EVALUATION CRITERIA

The following criteria are used to evaluate aircraft reconnaissance support to the JTWC.

a. Six-Hourly fixes - To be counted as made on time, a fix must satisfy the following criteria:

(1) Made not earlier than 1/2 hour before to 1 hour after scheduled fix time.

(2) Aircraft in area requested by scheduled fix time, but unable to locate a center due to:

(a) Cyclone dissipation; or

(b) rapid acceleration of the cyclone away from the forecast position.

(3) If penetration not possible due to geographic or other flight restriction, radar fixes are acceptable.

b. Levied 6-Hourly fixes made outside the above limits are scored as follows:

(1) Early - fix made within the interval from 3 hours to 1/2 hour prior to levied fix time. No credit given for early fixes made within 1 1/2 hours of the previous fix.

(2) Late - fix made within the interval from 1 hour to 3 hours after levied fix time.

c. When 3-Hourly fixes are levied, they must satisfy the time criteria of paragraph one in order to be classified as made on time. Three-Hourly fixes made that do not meet the above criteria are classified as follows:

(1) Early - fix made within the interval from 1 1/2 hours to 1/2 hour prior to levied fix time.

(2) Late - fix made within the interval from 1 hour to 1 1/2 hours after levied fix time.

d. Fixes not meeting the criteria of paragraphs one, two, and three are scored as missed. Requirements levied with less than 24 hours notification, if missed, are counted as unfulfilled. If the squadron is in an alert posture, the fix is scored as missed vice unfulfilled.

e. Levied fix time on an "as soon as possible" fix is considered to be:

(1) Sixteen hours plus estimated time enroute after an alert aircraft and crew are levied; or

(2) Four hours plus estimated time enroute after the DTG of the message levying an ASAP fix if an aircraft and crew, previously alerted, are available for duty.

f. Investigatives - To be counted as made on time, investigatives must satisfy the following criteria:

(1) Aircraft must be within 250nm of the levied investigative point by the specified time.

(2) The specified flight level must be flown.

(3) Reconnaissance observations are required every half-hour in accordance with AWSM 105-1. Turn and mid-point winds shall be reported on each full observation when within 250nm of the investigative point.

(4) Observations are required in all quadrants unless a concentrated investigation in one or more quadrants has been specified.

(5) Specified investigative track must be flown.

(6) Aircraft must contact JTWC before terminating the investigative.

g. Investigatives not meeting the time criteria of paragraph f. will be classified as follows:

(1) Late - aircraft is within 250nm of the investigative point after the specified time, but prior to the specified time plus 2 hours.

(2) Missed - aircraft fails to be within 250nm of the investigative point by the specified time plus 2 hours.

h. Requirements levied as "resources permitting" are not evaluated.

4. AIRCRAFT RECONNAISSANCE SUMMARY

There were 362 required six-hourly fixes in 1973, representing a record low since establishment of the JTWC. Of the 362 required fixes, 227 or 62.4% were levied upon aircraft. The remaining required fixes were satisfied by satellite, radar, extrapolation, or synoptic data. The SRP made it possible, when there was a choice between aircraft, radar, or satellite, to reduce the aircraft levy. By employing SRP, 45 fixes were levied upon satellite or radar, a savings of 16.5% in the use of aircraft. In addition to the 227 fixes, 28 investigatives were also levied on aircraft.

This total aircraft levy is only 38% of the average levy from 1965 through 1973. The mean deviation from the best track for all aircraft fixes was 16nm. This is a 2nm decrease from the average deviation for the past 3 years.

The total of 227 fixes levied does not include intermediate fixes, which averaged 131 for the past two years. The decrease in the number of intermediate fixes -- 182 in 1971, 81 in 1972, and none in 1973 -- and investigatives -- 179 in 1971, 81 in 1972, and 28 in 1973 -- during the past three years resulted from a CINCPAC request to reduce intermediate fixes and the application of the DMSP satellite data (Section 6).

Table 2-1 summarizes reconnaissance effectiveness. Using the scoring criteria in Section 3, the 13 missed plus unfulfilled fixes, or 5.7% of the total levied fixes, represent a significant decrease from the previous two year average of 13.9%. The percentage of late and early fixes rose from 10.6% in 1972 to 15.3% in 1973.

TABLE 2-1. AIRCRAFT RECONNAISSANCE EFFECTIVENESS

	NUMBER OF LEVIED FIXES	PERCENT
Completed on time	179	79.0
Early	4	1.7
Late	31	13.6
Missed	11	4.8
Unfulfilled	2	0.9
	227	100.0

LEVIED vs. MISSED FIXES

	LEVIED	MISSED	PERCENT
AVERAGE 1965 - 1970	507	10	2.0
1971	802	61	7.6
1972	624	126	20.2
1973	227	13	5.7

Figure 2-1 relates the number of fixes missed/unfulfilled to the monthly fix requirements and multiple-storm days, i.e., a day when two or more storms were active at the same time. The 82 levied fixes in October account for 36% of the total levied fixes. October also included 42% of the multiple storm days and 30% of the missed fixes as compared to August which had 22% of the storm days, but 46% of the missed fixes. August, however, had only 21% of the levied fix requirements.

Figure 2-2 compares the percentage of fixes and investigatives missed/late versus the number of storms per day. The 26 days with 2 or more storms represents only 35% of the calendar days of warning; however, they encompass 75% of the missed/late fixes and investigatives. This indicates, that even in a light season, concurrent storms can overtax current aircraft reconnaissance capabilities.

5. RADAR RECONNAISSANCE SUMMARY

A total of 419 radar reports of tropical cyclones were received during the 1973 season, 409 from land stations, 3 from ships, and 7 from aircraft. This is a significant decrease from 1972 when over 700 radar reports were received. There are two primary reasons for this decrease, the large decrease in tropical cyclone activity from 1972 to 1973 and the significant reduction of military activities in the western North Pacific and South China Sea areas.

To evaluate the 1973 data in terms of quality, the land radar reports received were grouped into three accuracy categories, a method provided for in the WMO code. The categories used are defined as good (less than 6nm), fair (6-20nm), and poor (greater than 20nm). Using this stratification, 32% of the reports were classified as good, 40% as fair, and 28% as poor. In addition to the above accuracy classifications which are derived from the radar operations, all land radar reports were compared to the JTWC best track positions and deviations computed. The mean deviation was 12nm, a 29% decrease from the average of 17nm for the previous three years.

The radar sites that provide some of the most significant coverage to JTWC are those whose surveillance borders within the Air Weather Service no-fly zone. The Royal Observatory at Hong Kong provided valuable positioning information on 7 tropical cyclones during 1973 in which geographical restrictions existed to reconnaissance air-

craft. Other locations which play similar roles are those situated on western Taiwan and Korea, although by the time a tropical cyclone reaches the latitude of Korea its radar presentation is often quite deteriorated. A key station for tracking tropical cyclones in the northwestern South China Sea during the Vietnam conflict was the Monkey Mountain site at Danang. The loss of observations from this site last season proved quite critical during typhoon Anita's trek into the Gulf of Tonkin this past July, adversely affecting units of the 7th Fleet.

The receipt of land radar reports from national meteorological and AC&W sites in the Republic of the Philippines was greatly improved in 1973 compared to previous years. This improvement is attributed to recent improvements in the radar network, better communications, and closer liaison between U.S. military and Philippine officials.

Of 17 tropical cyclones which came within the surveillance range of the Far East radar networks, four typhoons Ellen, Billie, Nora, and Dot accounted for the majority of radar reports. Each of these storms was characterized during periods of observation by slow movement allowing for numerous position reports. Billie while passing through the southern Ryukyus was under coverage of 6 radars simultaneously for a 12 hour period. Radars of National Meteorological Services accounted for 70% of the 419 observations received at the JTWC for tropical cyclones during 1973. AC&W sites furnished 23% and Air Weather Service radars, contributed 8%.

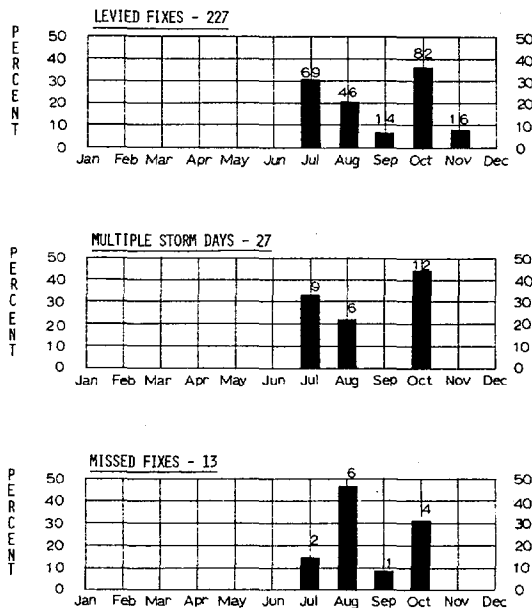


FIGURE 2-1. Missed fixes for 1973 compared to monthly fix requirements and multiple storm days.

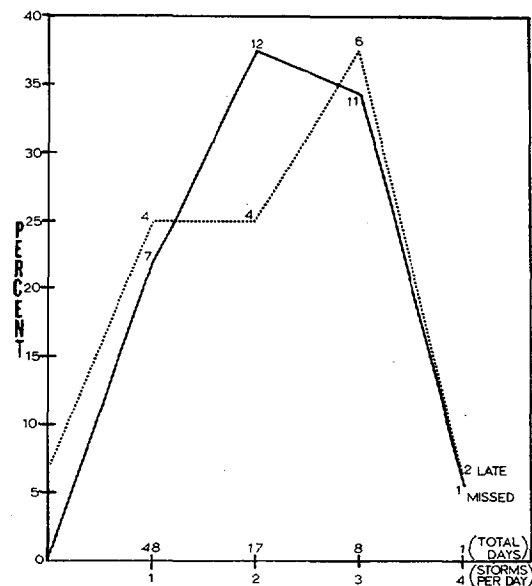


FIGURE 2-2. Percentage of fixes and investigatives missed/late vs. storms per day.

6. SATELLITE RECONNAISSANCE SUMMARY

Satellite reconnaissance information is provided to the JTWC by the Air Force Defense Meteorological Satellite Program (DMSP) site collocated with the JTWC. This site was established in May 1971. During the 1971 storm season, DMSP data were available to the JTWC forecasters but were not authorized by CINCPAC as a substitute for aircraft fixes. Coincident with the site's establishment was the implementation of a Technique Development Program (TDP) designed to determine the potential of DMSP data as an alternative reconnaissance platform. This was necessary as aircraft resources were being reduced and it was possible that the remaining reconnaissance fleet would be subject to further reductions. Hence the SRP concept was introduced. Under the SRP, the JTWC would selectively levy reconnaissance requirements on aircraft, high resolution satellites and land radar with the satellites expected to fulfill an increasingly important role.

By the end of 1971, the TDP had established the viability of satellite derived storm positions and intensity estimates. Plans were then made to implement the SRP. During 1972, techniques used to position tropical cyclones and estimate their intensities from DMSP data were further refined. An organized approach to daily decision making on the use of DMSP data in lieu of aircraft was implemented beginning with Typhoon Phyllis in July 1972. Factors such as satellite coverage of the storm, timeliness of the DMSP data, and quality of the position were considered in this decision process. During the remainder of 1972, satellite fixes were levied in lieu of aircraft 12% of the time. During 1972, the Guam site provided the majority of satellite data used operationally by the JTWC. Data were received from other Pacific DMSP sites and the Air Force Global Weather Central (AFGWC) but there was no formal program to rely on these data.

Prior to the start of the 1973 season, an SRP network was established consisting of Guam; Fuchu, Japan; and Nakon Phanom (NKP), Thailand (primary sites); and Kadena, Okinawa; Osan, Korea; and AFGWC serving as backup sites. The network was designed to provide timely DMSP data to the JTWC through the Guam site which served as clearing house and quality control monitor. The Guam site was also responsible to the JTWC for forecasting which of the primary sites or combination of sites would receive usable fixes. Regardless of whether such fixes were levied in lieu of aircraft, the sites affected would be notified by message to pass the required information to the JTWC. As the data were received, processed, and analysed, data were first passed by phone to the Guam site and followed up by message to the JTWC.

There are six position classes referred to by Position Code Numbers (PCN). The PCN identifies the method of gridding and the type of circulation center; it also has associated with it a set of statistics related to its accuracy. Table 2-2 provides the methods of center determination and gridding for each PCN. The mean error,

standard vector deviation, and sample size are given for the 3 major classes i.e. eye, well-defined circulation center, and poorly defined circulation center. While no statistically significant difference presently exists between geographical and ephemeris gridded positions, it was decided to retain the gridding method as part of the PCN stratification to provide a check on the accuracy of ephemeris gridding and to isolate any problems growing out of either geographical or ephemeris gridding in the future.

TABLE 2-2. GUAM DMSP SITE TROPICAL CYCLONE POSITIONING STATISTICS, 1973 (1972)

PCN	METHOD OF CENTER DETERMINATION/GRIDDING	MEAN ERROR (NM)	STANDARD VECTOR DEVIATION (NM)	SAMPLE SIZE
1	Eye/Geography	15.5 (14.7)	17.8 (17.3)	40 (137)
2	Eye/Ephemeris			
3	Well Defined CC/Geography	18.9 (21.0)	22.9 (26.3)	86 (139)
4	Well Defined CC/Geography			
5	Poorly Defined CC/Geography	30.8 (30.2)	54.2 (36.6)	86 (294)
6	Poorly Defined CC/Geography			

NM = Nautical Miles
CC = Circulation Center

The 1972 figures which serve as the standard are given in parentheses. Table 2-3 shows corresponding 1973 figures for NKP and Fuchu respectively. Only PCN's of 1 through 4 are considered as quality fixes, i.e. location accuracy comparable on the average to that expected from the aircraft. It should be noted that only 31% of the positions made during 1973 by the primary DMSP sites were of PCN's 5 or 6, a significant reduction from 1972 when 50% of the positions were classified in the poorly defined category.

With only one operational satellite during the early part of the 1973 season (July and August), satellite coverage during the period 5 1/2 hours before to 1/2 hour after warning time was available for 52% of the warnings. However, during the last part of the season (September, October, and November) with two functional satellites, 87% of the warnings had satellite coverage available during the same time

TABLE 2-3. DMSP TROPICAL CYCLONE POSITIONING STATISTICS 1973

NAKON PHANOM, THAILAND			
PCN	MEAN ERROR (NM)	STANDARD VECTOR DEVIATION (NM)	SAMPLE SIZE
1&2	16.8	20.0	47
3&4	19.1	25.4	62
5&6	48.1	66.3	85
FUCHU, JAPAN			
PCN	MEAN ERROR (NM)	STANDARD VECTOR DEVIATION (NM)	SAMPLE SIZE
1&2	15.4	17.7	37
3&4	20.9	25.0	75
5&6	36.2	51.4	26

period. For 24% of the 390 warnings issued by the JTWC, both satellite coverage and timeliness of the data were met simultaneously. In this context, timeliness is defined as having DMSP satellite data with nodal times of 1 1/2 to 3 hours (descending node) or 1 3/4 to 3 hours (ascending node) prior to warning time. When quality PCN's are also stipulated, it was found that for only 14% of the warnings were coverage, timeliness, and quality PCN forecast to occur. When the three criteria given above are anticipated, the forecast is referred to as SRP quality. The verification rate for SRP quality forecasts during the season was 90%. The actual use rate of satellite as the basis for warnings was considerably larger than the 14% which were forecast to be of SRP quality. Altogether, 27% of the JTWC warnings were based on satellite data. Of the forecast SRP quality fixes, 25% were levied equating to 13% of the satellite fixes used for warnings. The remaining 87% of the satellite fixes for warnings consisted of non-SRP quality and some additional SRP quality which were forecast, not levied, but subsequently used. A summary of these SRP statistics is given in Table 2-4.

There were a wide variety of satellite products available from the SRP network during the 1973 season both for real-time analysis by the individual sites and post-analysis conducted by the Guam site and the JTWC. Historically, the types of data from

the DMSP satellites have remained essentially unchanged during the past three years. Satellite meteorologists at the SRP network sites had available Very High Resolution daytime and nighttime infrared (VHR), and High Resolution daytime and nighttime visual (HR) and infrared (IR). Table 2-5 provides the imagery data characteristics.

During daytime, VHR along with IR are the primary data used for positioning and intensity analysis. In addition, visual and IR data enhancement techniques have been developed which often permit the analyst to locate the circulation center when the primary data alone would result in a poorly defined center. Likewise, nighttime position can often be classified as eye fixes or well defined centers as a result of having HR data from moonlight available. Marginal eye centers or well defined centers not visible on VHR can frequently be determined with as little illumination as that provided by a half-moon.

Satellite data are playing an increasingly larger role in tropical cyclone reconnaissance. For example, the operational use of DMSP data has produced a significant decrease in the number of aircraft investigative flights flown. For the two years preceeding the establishment of the SRP network (1970 - 1971), the ratio of investigative flights flown to the number of storms was 5.5:1, while for 1973 this ratio was reduced to 1.2:1.

7. COMMUNICATIONS

a. AIR TO GROUND

Aircraft reconnaissance data are normally received by the JTWC via direct phone patch through Andersen, Clark, or Fuchu aeronautical stations. Under degraded propagation conditions, data can be intercepted by a weather monitor located near these stations and relayed by AUTOVON or teletype to the JTWC.

Average communications delays for the preliminary and complete center data messages for past years are compared with 1973 delays in Figure 2-3. Delay times are defined here as the difference between the fix time and the time of message receipt at the JTWC. The preliminary fix message was introduced in 1972 to reduce delays in the receipt by the JTWC of vital position and intensity information. After two years of use, it has proved its effectiveness and permits a significant amount of extra time to be spent in forecast preparation. The 48 minute average delay in the complete center data message during 1973 shows an increase of about 14 minutes over 1972. This increase is attributed to several circumstances which prevailed during the 1973 season: (a) more emphasis was placed upon receipt of the preliminary message during 1973, lessening the need for passing the complete center message to the JTWC as quickly as before, (b) messages were more carefully prepared, and (c) a larger share of the messages were passed through Clark aeronautical station than in previous years due to location of cyclone tracks. This routing of phone patches through Clark places more stringent requirements on radio-telephone quality and has been

TABLE 2-4. SELECTIVE RECONNAISSANCE PROGRAM SUMMARY

PARAMETERS	RATIO	PERCENT
Number of cases where there was DMSP coverage of storm and timeliness for use in warning/total number of warnings issued	95/390	24
Number of cases where there was coverage of storm, timeliness of data, and PCN < 4 (SRP Quality forecasts made)/total number of warning issued	56/390	14
Number of SRP quality forecasts levied/number of SRP quality forecasts made	14/56	25
Number of SRP quality forecasts used as basis for warnings/number of warnings based on satellite	14/107	13
Number of warnings based on satellite/total number of warnings issued	107/390	27

TABLE 2-5. DMSP IMAGERY DATA CHARACTERISTICS

PARAMETER	VISUAL		INFRARED	
	VHR	HR	WHR	IR
Resolution (nautical miles)	0.33	2.0	0.5	2.0
Bandwidth (micrometers)	0.4-1.1	0.4-1.1	8.0-13.0	8.0-13.0
Equivalent blackbody temperature (°Kelvin)			217-307	210-310

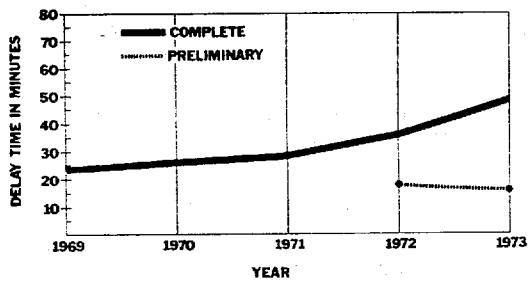


FIGURE 2-3. DELAY TIMES - Receipt of eye data message.

noted in previous years to result in longer delays than a direct phone patch through Andersen aeronautical station.

Table 2-6 depicts the complete center data messages received over one hour after fix time and after warning time. The growth of the percentages in 1973 can be partially attributed to the above mentioned reasons and the increase in the percentage of late fixes (section 4). Nevertheless, only 3% of the messages were delayed more than 80 minutes.

TABLE 2-6. 1973 AIR/GROUND DELAY STATISTICS FOR AIRCRAFT RECONNAISSANCE COMPARED WITH PREVIOUS YEARS

	1967	1968	1969	1970	1971	1972	1973
% COMPLETE FIX MESSAGES DELAYED OVER ONE HOUR	16	4	3	5	6	6	20
% COMPLETE FIX MESSAGES RECEIVED AFTER WARNING TIME	3.1	0.7	0.6	0.9	2.1	5.5	10.1

b. SELECTIVE RECONNAISSANCE PROGRAM

With the advent of the SRP, the importance of radar and satellite fix data has increased from previous years; therefore, a review of the associated communications delays follows. A sampling of radar messages resulted in a considerable variation of receipt delays. Delay times are defined as the differences between the observation time and the time of message entry into the AWN. Several sources were consistently associated with small delay times, while the receipt time of others were highly erratic. AC&W radar site data from the Republic of the Philippines were normally received within 35 minutes. Data from nationally operated radars of the Republic of China, Hong Kong, Japan, and Republic of the Philippines were delayed 20 to 50 minutes depending on country of origin. In the worst cases, the JTWC still received the messages within 90 minutes of observation time. Tropical cyclone radar data is routed to the JTWC over the AWN through the use of a special high precedence collective indicator. Additionally, the AC&W radar messages were phoned to the JTWC from Clark AB, thus providing the information somewhat earlier than indicated.

Over 750 position and intensity estimates were derived from Air Weather Service (AWS) DMSP sites and the aircraft carrier CONSTELLATION during 1973. The data from the AWS DMSP sites were immediately

passed by AUTOVON followed by an AWN message. AUTOVON provided rapid communication of the essentials and a brief two-way discussion of the data (a benefit not possible with message). Average delay times of 51 minutes for telephone and 83 minutes for message resulted from a sampling of the last six storms. These delay times are the difference between satellite equator-crossing time and the time of the telephone call or entry of the message into the AWN. systematic differences in data processing time among the DMSP sites introduces small variations in the above figures which are independent of communications and analysis time. However, it is important to note, that on the average, the data were available to the JTWC within one hour after equator-crossing time.

c. OUTGOING COMMUNICATIONS

Messages originating at the JTWC are handled by the Nimitz Hill Message Center Naval Communications Station, Guam (NHMC). By special agreement, typhoon and tropical storm warnings are placed in the communications system before pending immediate precedence traffic. Manual processing is accomplished as though the warning had flash precedence. Tropical depression warnings are normally handled as immediate messages. Warnings were delivered to the message center an average of 23 minutes before warning time (Figure 2-4). Yearly averages of the parameters described are plotted relative to warning time. The length of the vertical bars represents the average difference between the time typhoon and tropical storm warnings were passed to the NHMC and the time of transmission. Note that the handling time decreased from 31 minutes in 1972 to 15 minutes in 1973. Handling times for tropical depression warning (not shown) were reduced from 51 minutes in 1972 to 25 minutes in 1973.

The dramatic improvement in handling time during 1973 allowed the average message to be placed in the circuits before the established warning time. This was a major improvement over the previous two years when the average message left Guam more than 10 minutes after warning time. The reduced handling time can be attributed primarily to rectification of problems within the NHMC itself. The time of receipt of a warning at a particular station depends on factors beyond the control of both the JTWC and the NHMC.

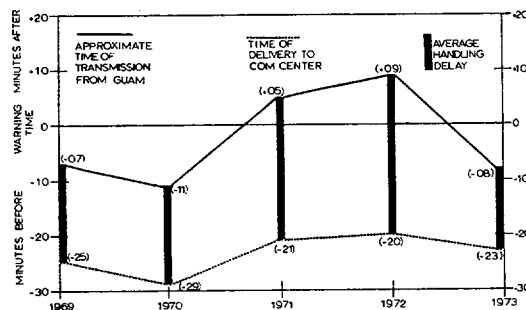


FIGURE 2-4. AUTODIN handling time data for typhoon and tropical storm warnings.

CHAPTER III — RESEARCH SUMMARY

1. GENERAL

In past years, technical notes summarizing research studies made by the JTWC personnel were included in the Annual Typhoon Reports (ATRs). In this and future ATRs, however, only brief synopses of these studies will be given. The complete studies will be published separately as FLEWEACEN/JTWC Technical Notes. It is felt that this procedure offers several advantages. First, it allows the administrative workload associated with publication preparation to be distributed throughout the year rather than concentrated within a few months during preparation of the ATR. Second, it allows authors to include more technical details of their studies than would be appropriate for inclusion in the ATR.

2. INVESTIGATION OF GUST FACTORS IN TROPICAL CYCLONES

(Reference: Atkinson, G.D., FLEWEACEN/JTWC Technical Note 74-1).

The 1972 Tropical Cyclone Conference requested that FLEWEACEN/JTWC include peak gusts in the warnings when sustained surface wind speeds equal or exceed 50 kts. During 1972, a sustained wind/peak gust graph derived by former JTWC personnel was used. Details on how this graph was derived were not available and there was a general feeling among JTWC forecasters that the gust factors derived from this graph were too high for open water conditions. Therefore, at the 1973 Tropical Cyclone Conference, FLEWEACEN/JTWC requested that all 7th Fleet ships equipped with anemometers include peak gusts as well as sustained winds in their weather reports during strong wind conditions. These ship observations and a comprehensive literature survey led to the derivation of a new sustained wind/peak gust relationship which was introduced into operational use by the JTWC during the 1973 season. This study showed that for strong wind conditions, gust factors (i.e., ratio of peak gusts to one-minute average sustained wind speeds) over open water should fall in the range of 1.20 to 1.25. Based on these results, the sustained wind/peak gust relationships shown in Table 3-1 are now used operationally by the JTWC.

TABLE 3-1. JTWC SUSTAINED 1-MINUTE WIND-PEAK GUST (KNOTS) RELATIONSHIPS

WIND(GUST)	WIND(GUST)	WIND(GUST)
50(65)	95(115)	140(170)
55(70)	100(125)	145(175)
60(75)	105(130)	150(180)
65(80)	110(135)	155(190)
70(85)	115(140)	160(195)
75(90)	120(145)	165(200)
80(100)	125(150)	170(205)
85(105)	130(160)	175(210)
90(110)	135(165)	180(220)

3. INTENSITY FORECASTING USING THE TYFOON ANALOG COMPUTER PROGRAM

(Reference: Craiglow, L.H., Jr., FLEWEACEN/JTWC Technical Note 74-2).

The computerized TYFOON analog program has been used by the JTWC as an aid in forecasting tropical cyclone movement since 1970. This study investigated the usefulness of the TYFOON program for forecasting tropical cyclone intensities at 24-, 48-, and 72-hours. It modified and extended a previous study on this subject by former JTWC personnel. Three parameters which are available on the basic climatological data tape used in the TYFOON program were selected to determine their usefulness in intensity forecasting. These are the minimum sea level pressure, the 12-hour change in minimum sea level pressure, and the maximum sustained surface wind speed. Based on selected values of these criteria, current and analog tropical cyclones were separated into two classes (deepening or weakening) and analog forecasts were computed. During the testing, several changes were made to the classification criteria to obtain better results. Also, it was determined that intensity forecasts computed independently for the various time periods were not consistent. Therefore, the program was modified so that each succeeding intensity forecast used the previous intensity forecast as an input, i.e., initial conditions for the 48-hour forecast would depend on the 24-hour forecast, etc. Verification results based on selected cases from the 1972 tropical cyclone season showed the analog program produced intensity forecasts that were slightly better than the official JTWC forecasts for the 24-hour period but were slightly worse than the official forecasts at 48 and 72 hours. Nevertheless, these preliminary results indicate that further testing of this program is warranted to provide another objective forecast aid to JTWC forecasts.

4. EVALUATION OF THE EXTRAPOLATION FEATURE OF THE TYFOON ANALOG COMPUTER PROGRAM

(Reference: Craiglow, L.H., Jr., FLEWEACEN/JTWC Technical Note 74-3).

The original version of the TYFOON analog program, first used operationally by the JTWC in 1970 has been modified several times to improve its performance. In the TYFOON-72 version of the program, if a selected analog storm had insufficient positions to provide a forecast out to 72 hours, the program extrapolated up to four additional six-hourly positions. This extrapolation feature was necessary because of premature termination of many tropical cyclones on the original data tape (1945-1969). During 1972, tropical cyclone data for 1970 and 1971 were added to the basic climatological data tape and tracks for all tropical cyclones for the entire period of record (1945-1971) were extended. These modifications to the data tape and reductions of the basic time interval for selection of analog cases from ± 50 days to ± 35 days resulted in the version of the TYFOON

program known as TYFN 73. Since the original tropical cyclone tracks were subsequently extended, it was felt that the extrapolation feature of TYFOON-72 was no longer required. To test this hypothesis, 15 cases from 1972 were selected and 24-, 48-, and 72-hour position forecasts were prepared using both TYFOON-72 and TYFN 73. The overall results showed the average forecast errors for TYFN 73 were slightly lower than TYFOON-72 at all time periods. The most significant fact, however, was that TYFN 73 required 46% less computer time on the average than TYFOON-72. Considering that the JTWC requires hundreds of analog forecasts each year, the savings in computer time will be significant. The JTWC will use the TYFN 73 version of the analog program during the 1974 tropical cyclone season.

5. A COMPARISON OF THE SENSITIVITY OF TWO SIMILAR OBJECTIVE FORECAST TECHNIQUES

(Reference: Craiglow, L.H., Jr., FLEWEACEN/JTWC Technical Note 74-4).

A number of computerized objective forecast techniques are available to assist the JTWC in the preparation of warnings. Of concern is the sensitivity of these techniques to errors in the warning and history positions. Two techniques, TSGLOB, developed by FLEWEACEN Pearl Harbor, and its successor, TYMOD, developed by FLEWEACEN/JTWC Guam, were chosen for testing. Both techniques utilize the 24-hour global band upper air progs (GBUA) provided by FLENUMWEACEN Monterey. The 03/0000 GMT January 1973 GBUA fields were chosen and a control forecast for each technique was run on Guam's CDC 3100 computer. Errors of six and 12nm were introduced into the warning and history positions, both individually and collectively. Thirty-six cases were run for TYMOD and 20 for TSGLOB the difference being due to TYMOD having a 24-hour history position. The results showed that TYMOD was less sensitive to positioning errors than TSGLOB. In addition, the TYMOD errors tended to reach a maximum about +48 hours and then decrease in magnitude thereafter. Finally, the test results suggest that as much as 30% of the 24-hour forecast error may be caused by warning position errors.

6. INTERANNUAL VARIABILITY OF RAINFALL AND TROPICAL CYCLONE ACTIVITY IN THE WESTERN NORTH PACIFIC

(Reference: Pratte, J.F., FLEWEACEN/JTWC Technical Note 74-5).

In this study, rainfall amounts at various stations in the tropical North Pacific during the dry season (January-April) were correlated with the number of tropical cyclones occurring in the western North Pacific area during the same year. The period of record used was 1959-1973. This period was selected because the JTWC was established in 1959 and satellite coverage of the tropics was available for most of this period. Therefore, it was felt that statistics on the number of tropical cyclones would be highly reliable for this recent period. Correlations were made for each rainfall station individually and for various groups of stations. Results indicate that the best correlation was shown with rainfall on Guam (average of three Guam stations), however, the relationship was poor (correlation coefficient of 0.24) and not sufficient for long-range forecasting purposes. The study also provides a survey of various articles relating tropical circulation patterns and rainfall to sea surface temperature anomalies and other large scale influences.

CHAPTER IV — SUMMARY OF TROPICAL CYCLONES

1. GENERAL RESUME

The western North Pacific remained quiescent for the first six months of 1973 before the first tropical cyclone developed. Since World War II, only in 1952, when five months passed without a single tropical cyclone, has this area experienced such a late start of the tropical cyclone season (Table 4-1). According to statistics compiled by the Royal Observatory of Hong Kong, this dearth of tropical cyclone activity during the first six months of the year has not occurred since 1917. Interestingly, on the average, five tropical cyclones form during the first six months of the year of which three became typhoons.

The development of Tropical Storm Wilda on 1 July marked the beginning of the 1973 season. Within a span of 5 months, a total of only 21 named tropical

cyclones developed, with 12 of these reaching typhoon intensity. Additionally, warnings were issued on two numbered tropical depressions. Typhoon frequency in 1973 was significantly lower than the yearly average of 19 since the establishment of the JTWC in 1959. Only 1969 and 1970 experienced a similar low frequency of typhoons during this period (Table 4-2).

In 1973, warnings were issued on only 77 calendar days, approximately one half of the 14-year average of 145 days. The JTWC remained in warning status 62 days less in 1973 than in 1972, an active tropical cyclone year.

Typhoon days for 1973 dipped to a record low of 42 compared to 121 in 1972 (Table 4-3). Based on the past 15 years, 1973 was 54 days below the average and 20 days below 1969 the next lowest. These facts indicate that there was not only a

TABLE 4-1. FREQUENCY OF TROPICAL STORMS (INCLUDING TYPHOONS) BY MONTHS AND YEARS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1945	0	0	0	1	1	2	5	7	6	1	3	0	26
1946	0	0	1	0	1	2	3	2	3	1	2	0	15
1947	0	0	1	0	1	1	3	3	5	6	6	1	27
1948	1	0	0	0	2	2	2	5	5	4	3	2	26
1949	1	0	0	0	0	1	5	3	6	1	3	2	22
1950	0	0	0	0	1	2	3	2	3	3	3	1	18
1951	0	0	1	2	1	1	1	2	2	4	1	2	17
1952	0	0	0	0	0	3	3	4	5	6	3	4	28
1953	0	1	0	0	1	2	2	6	3	4	3	1	23
1954	0	0	1	0	1	0	1	6	4	3	3	0	19
1955	1	0	1	1	0	1	6	3	3	4	1	1	22
1956	0	0	1	2	0	1	2	5	5	2	3	1	22
1957	2	0	0	1	1	1	1	3	5	4	3	0	21
1958	1	0	0	0	1	3	5	3	3	3	2	1	22
1959	0	1	1	1	0	0	3	6	6	4	2	2	26
1960	0	0	0	1	1	3	3	10	3	4	1	1	27
1961	1	1	1	1	3	2	5	4	6	5	1	1	31
1962	0	1	0	1	2	0	6	7	3	5	3	2	30
1963	0	0	0	1	1	3	4	3	5	5	0	3	25
1964	0	0	0	0	2	2	7	9	7	6	6	1	40
1965	2	2	1	1	2	3	5	6	7	2	2	1	34
1966	0	0	0	1	2	1	5	8	7	3	2	1	30
1967	1	0	2	1	1	1	6	8	7	4	3	1	35
1968	0	0	0	1	1	1	3	8	3	6	4	0	27
1969	1	0	1	1	0	0	3	4	3	3	2	1	19
1970	0	1	0	0	0	2	2	6	4	5	4	0	24
1971	1	0	1	3	4	2	8	4	6	4	2	0	35
1972	1	0	0	0	1	3	6	5	4	5	2	3	30
1973	0	0	0	0	0	0	7	5	2	4	3	0	21
Totals	13	7	13	20	31	45	115	147	131	111	76	33	742
Average	.45	.24	.45	.69	1.07	1.55	3.97	5.07	4.52	3.83	2.62	1.14	25.59

TABLE 4-2. FREQUENCY OF TROPICAL STORMS REACHING TYPHOON INTENSITY BY MONTHS AND YEARS

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1945	0	0	0	0	0	1	2	5	3	1	1	0	13
1946	0	0	1	0	1	1	3	1	3	1	2	0	13
1947	0	0	0	0	1	1	0	3	4	5	4	1	19
1948	1	0	0	0	2	0	2	2	4	1	2	1	15
1949	1	0	0	0	0	1	3	3	3	1	1	1	14
1950	0	0	0	0	1	1	1	2	1	3	2	1	12
1951	0	0	1	2	1	1	1	2	2	3	1	2	16
1952	0	0	0	0	0	3	1	3	3	4	3	2	19
1953	0	1	0	0	1	1	2	4	2	4	1	1	17
1954	0	0	0	0	1	0	1	4	4	2	3	0	15
1955	1	0	1	1	0	1	5	3	3	2	1	1	19
1956	0	0	1	1	0	0	2	4	5	1	3	1	18
1957	1	0	0	1	1	1	1	2	5	3	3	0	18
1958	1	0	0	0	1	3	4	3	3	3	1	1	20
1959	0	0	0	1	0	0	1	5	3	3	2	2	17
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	3	5	3	1	1	20
1962	0	0	0	1	2	0	5	7	2	4	3	0	24
1963	0	0	0	1	1	2	3	3	3	4	0	2	19
1964	0	0	0	0	2	2	6	3	5	3	4	1	26
1965	1	0	0	1	2	2	4	3	5	2	1	0	21
1966	0	0	0	1	2	1	3	6	4	2	0	1	20
1967	0	0	1	1	0	1	3	4	4	3	3	0	20
1968	0	0	0	1	1	1	1	4	3	5	4	0	20
1969	1	0	0	1	0	0	2	3	2	3	1	0	13
1970	0	1	0	0	0	1	0	4	2	3	1	0	12
1971	0	0	0	3	1	2	6	3	5	3	1	0	24
1972	1	0	0	0	1	1	4	4	3	4	2	2	22
1973	0	0	0	0	0	0	4	2	2	4	0	0	12
Totals	8	2	6	17	24	31	75	103	93	84	52	22	517
Avg	.28	.07	.21	.59	.83	1.07	2.59	3.55	3.21	2.90	1.79	.76	17.83

short period of typhoon activity (July to October) but also the short duration of typhoons notably in August and September. The number of warnings issued totaled only 390 which is 55% of the average over the past 15 years. 1971 and 1972 could be considered "normal" years compared to 1973 since they were only slightly above the average with total number of warnings of 747 and 739, respectively. 1973 was not without multiple storm occurrences with 27 days with two or more cyclones and 9 days with three or more cyclones occurring simultaneously (Table 4-4).

There were only three super typhoons during 1973, Billie, Nora, and Patsy, which is half of the climatological mean of six based on the past 15 years. This is not surprising since most of the tropical cyclones developed outside of the favorable areas for super typhoon occurrence delineated by Holliday (1970).

The 1973 season was marked by another peculiarity. There was a pronounced absence of tropical cyclone activity in the area south of 20°N and east of 135°E which is normally a favorable area for tropical

cyclone development. Except for brief periods during the summer months, the eastward extension of the monsoon trough over the western North Pacific Ocean was noticeably missing. It was not until the latter half of the season that the monsoon trough became firmly established in the area to the south of Guam when 3 successive typhoons were spawned during the first half of October.

The Tropical Upper Tropospheric Trough (TUTT) was well established by mid-May. It initiated the development of Tropical Storm Clara in July and Tropical Storm Hope and Tropical Depression No. 11 in August. Although the TUTT was in evidence throughout the typhoon season, the near-equatorial ridge which normally forms to the south of the TUTT was absent except for brief periods. Consequently, upper level westerlies prevailed over the Caroline and Marshall Islands, an area which would normally be under deep tropospheric easterlies during the primary tropical cyclone season. The resulting strong vertical wind shear over the eastern Trust Territory was unfavorable for tropical cyclone development.

TABLE 4-3. TYPHOON DAYS 1959-1973

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL PER YEAR
1959	---	---	---	8	---	---	3	18	19	18*	10	18	94
1960	---	---	---	2	---	10	13	36*	---	23*	2*	12	98
1961	---	---	8	---	8	2	10*	15	23*	17*	6	6	95
1962	---	---	---	7	4	---	14*	37*	8	30*	19*	---	119
1963	---	---	---	4	5	15	11	23*	14*	24*	---	11	107
1964	---	---	---	---	7	5*	22*	18*	28*	14	11*	6	111
1965	2	---	---	2	5	12*	19*	23*	25*	14	6	---	108
1966	---	---	---	5	11	6	7*	16*	23*	11	4	3	86
1967	---	---	2	7	---	4	14*	10	32*	21*	21*	---	111
1968	---	---	---	6	1	7	6	8	32*	19	18*	---	97
1969	5	---	---	5	---	---	8	6	10	18	10*	---	62
1970	---	5	---	---	---	2	5	24*	16	21*	6	---	79
1971	---	---	---	4	13*	8	20*	27*	21*	11	7	---	111
1972	2	---	---	---	1	6	39*	16	16*	21	9	11	121
1973	---	---	---	---	---	---	11*	7*	4	20*	---	---	42
TOTAL	9	5	10	50	55	77	202	284	271	282	129	67	1441
MEAN	.6	.3	.7	4.0	3.7	5.1	13.5	18.9	18.1	18.8	8.6	4.5	96.1

*Two typhoons occurring on the same day are counted as two typhoon days.

TABLE 4-4. SUMMARY OF JTWC WARNINGS 1969-1973

	1960-1973 (AVG)	1970	1971	1972	1973
TOTAL NUMBER OF WARNINGS	707	533	747	739	390
CALENDAR DAYS OF WARNING	146	127	163	139	77
NUMBER OF WARNING DAYS WITH TWO OR MORE CYCLONES	52	29	54	46	27
NUMBER OF WARNINGS DAYS WITH THREE OR MORE CYCLONES	12	0	6	13	9

Based on available casualty reports, typhoons Nora and Ruth and tropical storms Sarah and Vera accounted for the majority of the tropical cyclone related casualties. Taiwan, South Vietnam, and the Republic of the Philippines bore the brunt of the storm damages and casualties. The Republic of the Philippines was again, as in 1972, particularly hard hit by the passage of Nora, Ruth, and Vera. The main Japanese islands, interestingly, did not experience coastal crossing of a typhoon during 1973 which is a first according to available records since 1945.

Much of the pertinent meteorological data and tropical cyclone damage statistics in this chapter were based on information received from the following

sources: Weather Bureau of the Republic of China; Royal Observatory of Hong Kong; Japan Meteorological Agency; National Weather Service of the Republic of the Philippines; the Environmental Data Service, National Oceanic and Atmospheric Administration and Casualty Returns, Liverpool Underwriters Association.

TABLE 4-5. LIST OF ESTIMATED CASUALTIES FOR THE 1973 SEASON

TYPE	NAME	DEATHS	MISSING
T	DOT	1	--
T	IRIS	2	3
T	NORA	22	48
T	RUTH	27	23
TS	SARAH	50	--
TS	VERA	75	58
total		177	132

NOTE: Only cyclones for which data are available are listed.

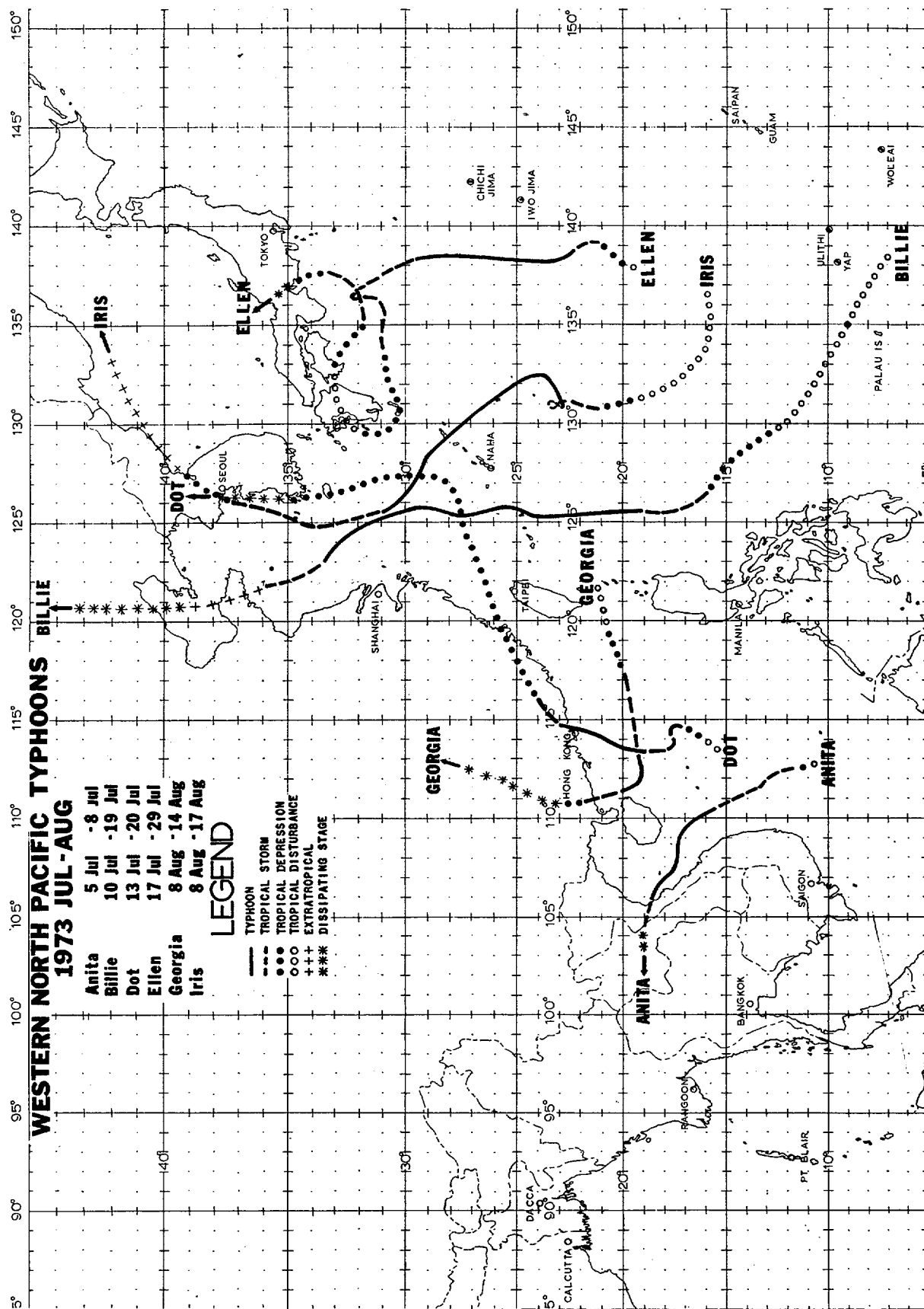
TABLE 4-6. 1973 TROPICAL CYCLONES

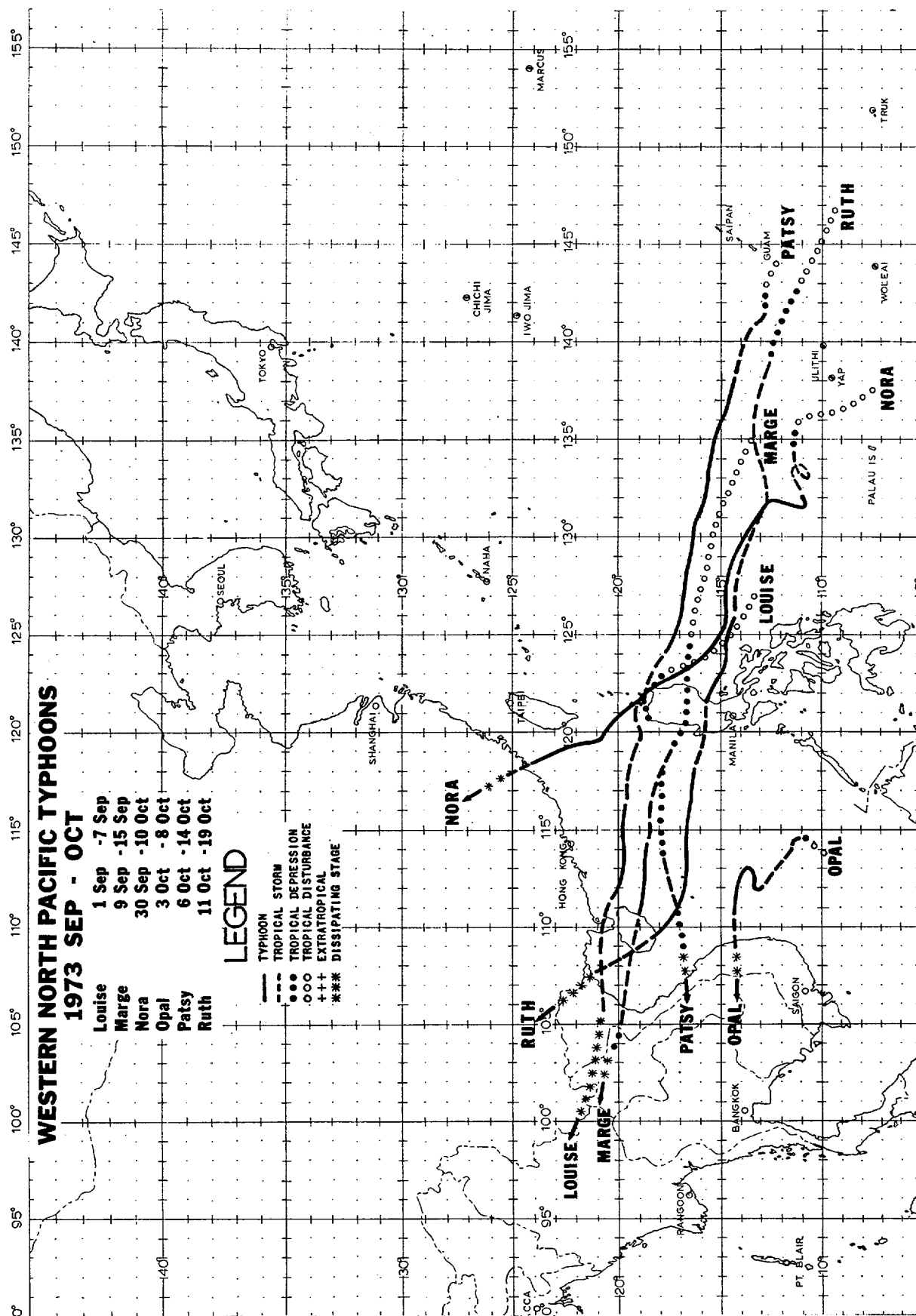
CYCLONE	TYPE	NAME	(PRD OF WRNG)	CALENDAR DAYS OF WARNING	MAX SFC WIND†	MIN OBS SLP	WARNINGS ISSUED		
							TOTAL	NO. AS TYPHOONS	DISTANCE TRAVELED
01	TS	WILDA	01 JUL-03 JUL	3	60	982	9	--	384
02	TY	ANITA	05 JUL-08 JUL	4	70	980	13	6	720
03	TS	CLARA	12 JUL-14 JUL	3	50	998	7	--	324
04	TY	BILLIE	13 JUL-19 JUL	7	130	916	27	18	1560
05	TY	DOT	*	6	85	978	19	4	1020
06	TY	ELLEN	*	10	105	941	29	8	1092
07	TS	FRAN	29 JUL-30 JUL	2	40	1002	6	--	330
08	TY	GEORGIA	09 AUG-12 AUG	4	70	976	15	9	504
09	TS	HOPE	09 AUG-12 AUG	4	45	996	15	--	756
10	TY	IRIS	10 AUG-17 AUG	8	85	972	30	16	1218
11	TD	TD-11	13 AUG-14 AUG	2	30	1005	6	--	270
12	TS	JOAN	18 AUG-20 AUG	3	45	990	10	--	648
13	TS	KATE	24 AUG-26 AUG	2	60	983	8	--	294
14	TD	TD-14	01 SEP-02 SEP	2	30	NA	4	--	90
15	TY	LOUISE	03 SEP-07 SEP	5	75	974	18	6	816
16	TY	MARGE	12 SEP-14 SEP	3	80	964	12	4	792
17	TY	NORA	02 OCT-10 OCT	9	160	877	34	25	1584
18	TY	OPAL	04 OCT-08 OCT	5	75	968	16	9	540
19	TY	PATSY	*	10	140	893	34	14	1920
20	TY	RUTH	11 OCT-19 OCT	9	90	957	33	23	2112
21	TS	SARAH	10 NOV-10 NOV	1	55	984	4	--	180
22	TS	THELMA	*	4	55	991	13	--	660
23	TS	VERA	19 NOV-26 NOV	8	50	990	28	--	1134
1973 TOTALS				77**			390	142	

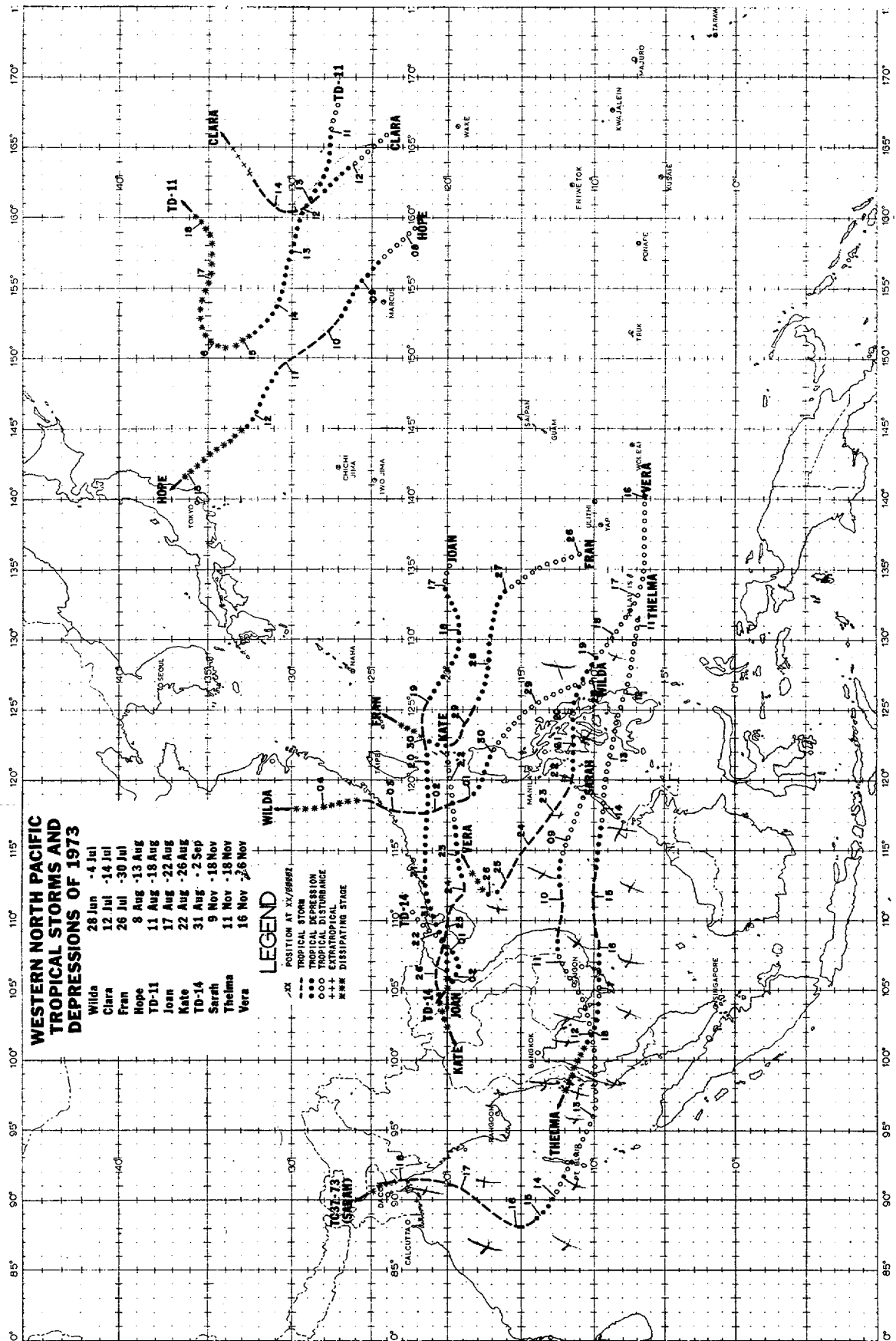
*Dot 14/06Z - 17/06Z and 19/00Z - 20/06Z JUL
 Ellen 17/18Z - 21/06Z and 23/06Z - 25/06Z and 28/00Z - 29/06Z JUL
 Patsy 06/06Z - 12/12Z and 13/12Z - 15/06Z OCT
 Thelma 15/00Z - 17/06Z and 18/06Z - 18/18Z NOV

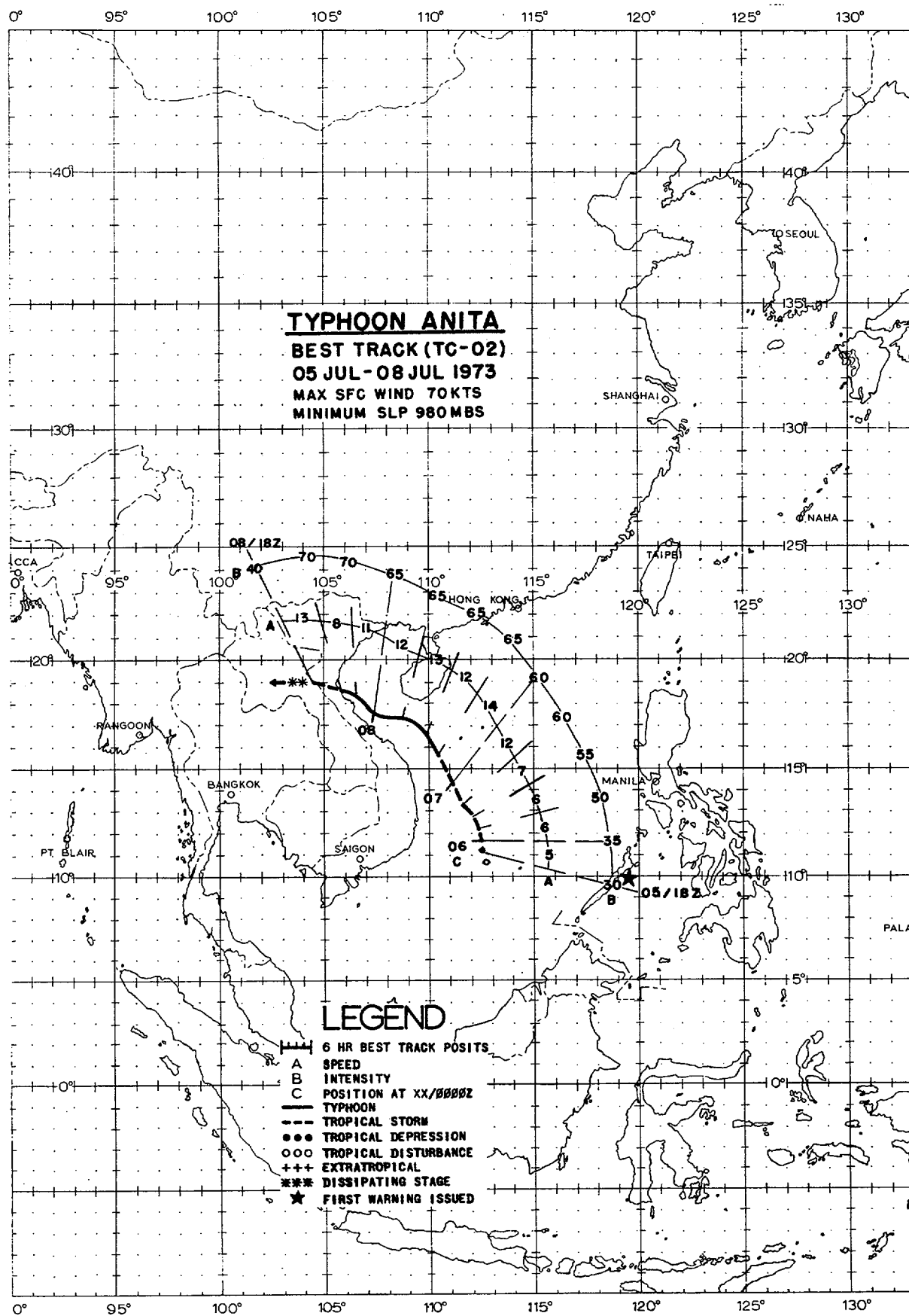
**Overlapping days included only once in sum
 † Over water estimate (one-minute averaging period)

DATA TAKEN FROM BEST TRACK









2. INDIVIDUAL TYPHOONS

ANITA

Anita, the season's first typhoon developed in the monsoon trough late on 5 July under conditions quite similar to those discussed by Ramage (1971). Several days prior to the initial development of Anita, the low level southwesterly flow throughout Indochina, the Malaysian Peninsula, and southern India increased from an average of 10 to 20 knots to speeds of 25 to 35 knots. The satellite mosaic on 4 July revealed that a band of cloudiness extending from the Arabian Sea to the South China Sea had increased markedly in response to the intensifying southwesterly flow (Figure 4-1).

Of particular interest during Anita's initial development were the strong winds (25 to 30 knots) extending more than 400nm from her center to the south with lighter winds (10 to 15 knots) near the large and diffuse center. These strong winds were primarily associated with the increased monsoon flow and not the storm itself, since Anita had not intensified sufficiently to produce the necessary pressure gradient to support such winds. Anita continued to exhibit this unusual wind structure as she intensified to typhoon strength (Figure 4-2). The USNS Washoe County reported winds in excess of 35 knots and mountainous seas over 150nm to the south of Anita (06/0900 GMT). Early

on the 7th, a reconnaissance aircraft reported Anita's sea level pressure had dropped to 983mb with flight level and surface winds of 50 to 80 knots within a band 30 to 60nm from the storm center, while winds within a 30nm radius of her center were 30 knots or less.

The storm initially drifted north-northwest in response to a weakness in the subtropical ridge to the north caused by the remains of Tropical Storm Wilda. However, by 1200 GMT, 7 July, significant height rises at 500mb indicated the ridge was reforming over southern China. As a result, Anita assumed a more westerly track.

The USS OGDEN (LPD-5) reported eye passage and greater than 60 knot winds (08/0000 GMT) near 17.5N 107.4E as her barometer registered 981mb. The barograph aboard the USS TRIPOLI (LPH-10) recorded eye passage (08/0100 GMT) as the ship steamed near 17.6N 107.2E (Figure 4-3).

A reconnaissance aircraft observed a minimum sea level pressure of 980mb and a well defined closed wall cloud indicating continued intensification as the storm neared the North Vietnamese coast (08/1010 GMT). Anita reached peak intensity of 70 knots prior to going ashore near Vinh, North Vietnam and quickly dissipated over land (Figure 4-4).

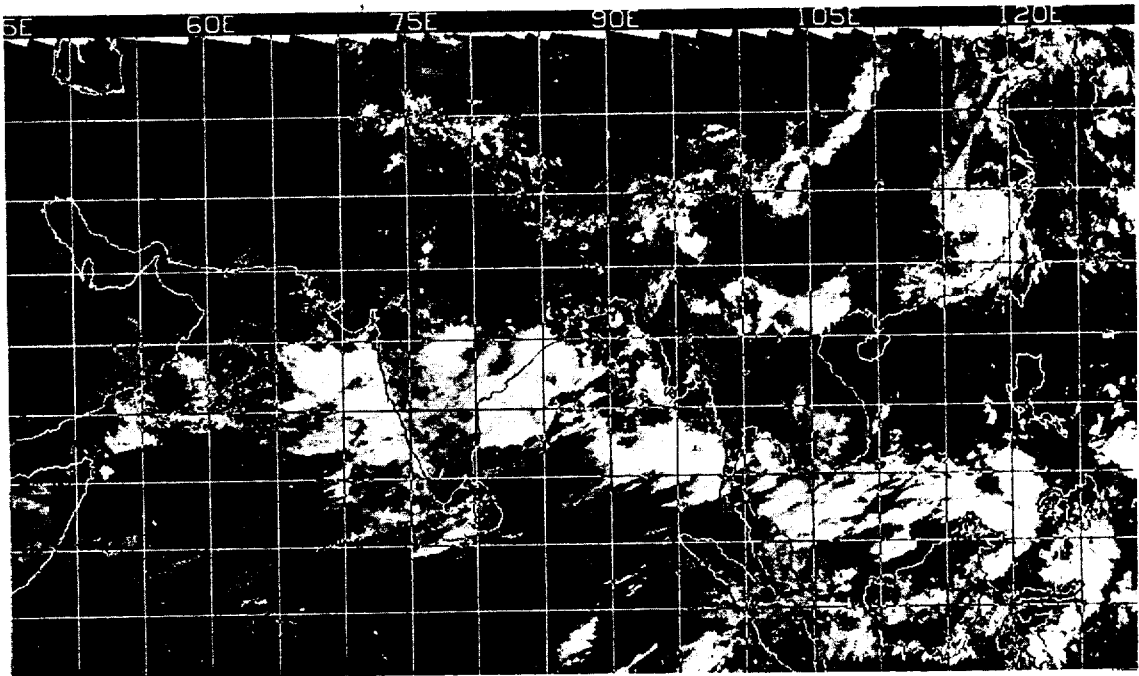


FIGURE 4-1. NOAA-2 satellite mosaic for 3 July 1973 showing cloud band associated with the southwest monsoon extending from the Arabian Sea to the South China Sea. Remnants of Wilda (A).

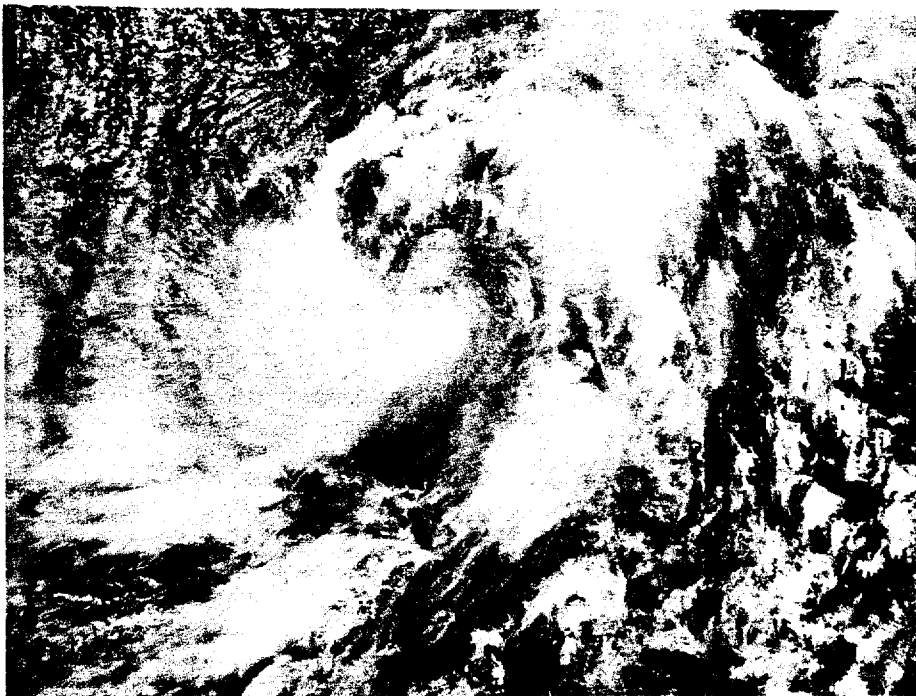


FIGURE 4-2. Tropical Storm Anita near typhoon intensity 110 nm off the coast of the Republic of Vietnam, 7 July 1973, 0444 GMT. (DMSP imagery)

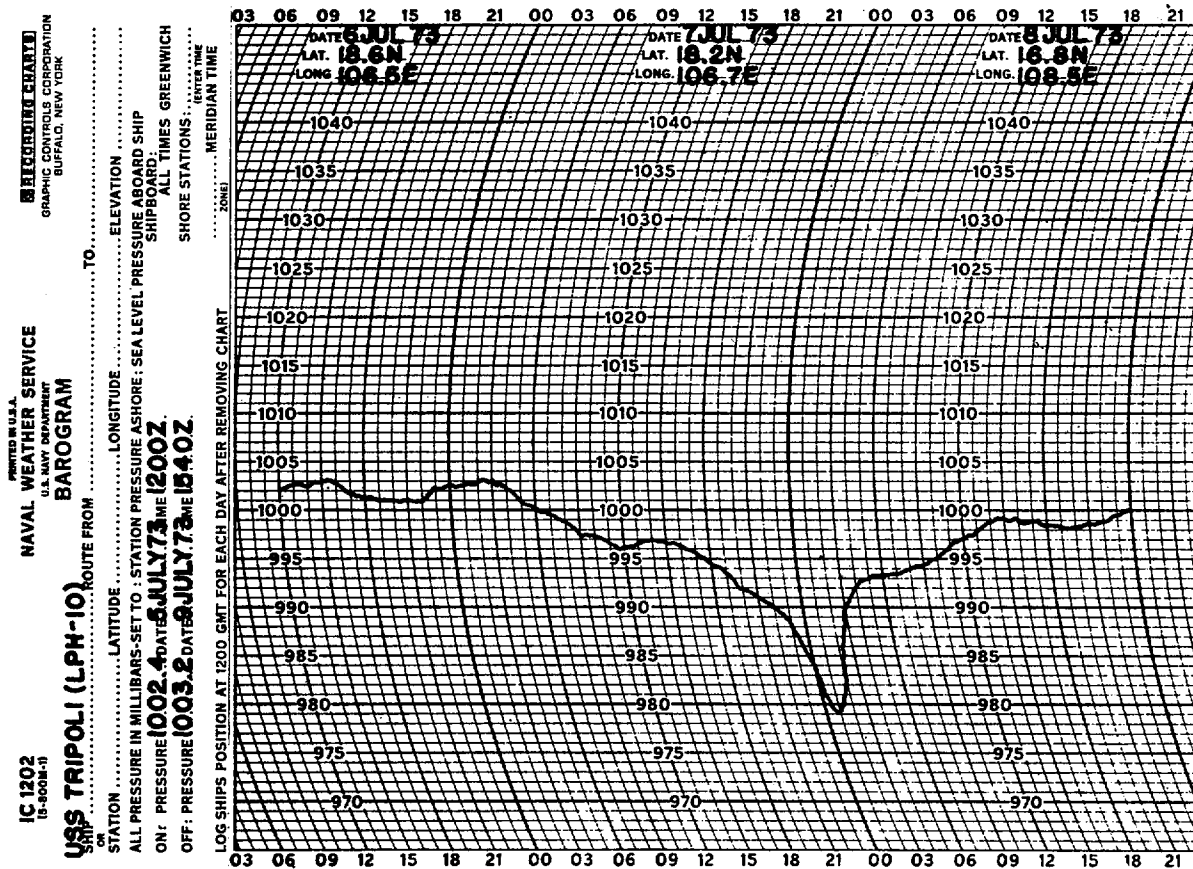


FIGURE 4-3. Reproduction of Barograph trace from the USS Tripoli (LPH-10) as she passed through the eye of Typhoon Anita.

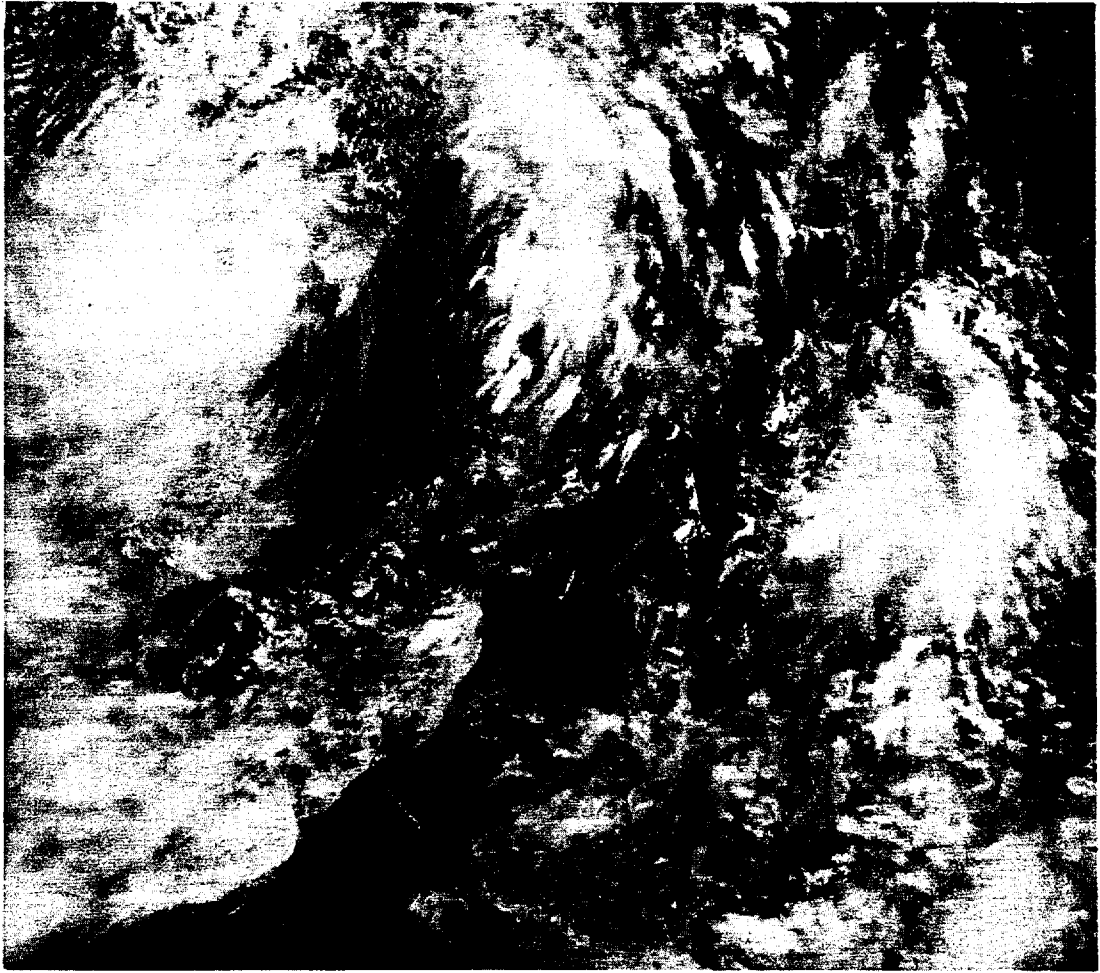
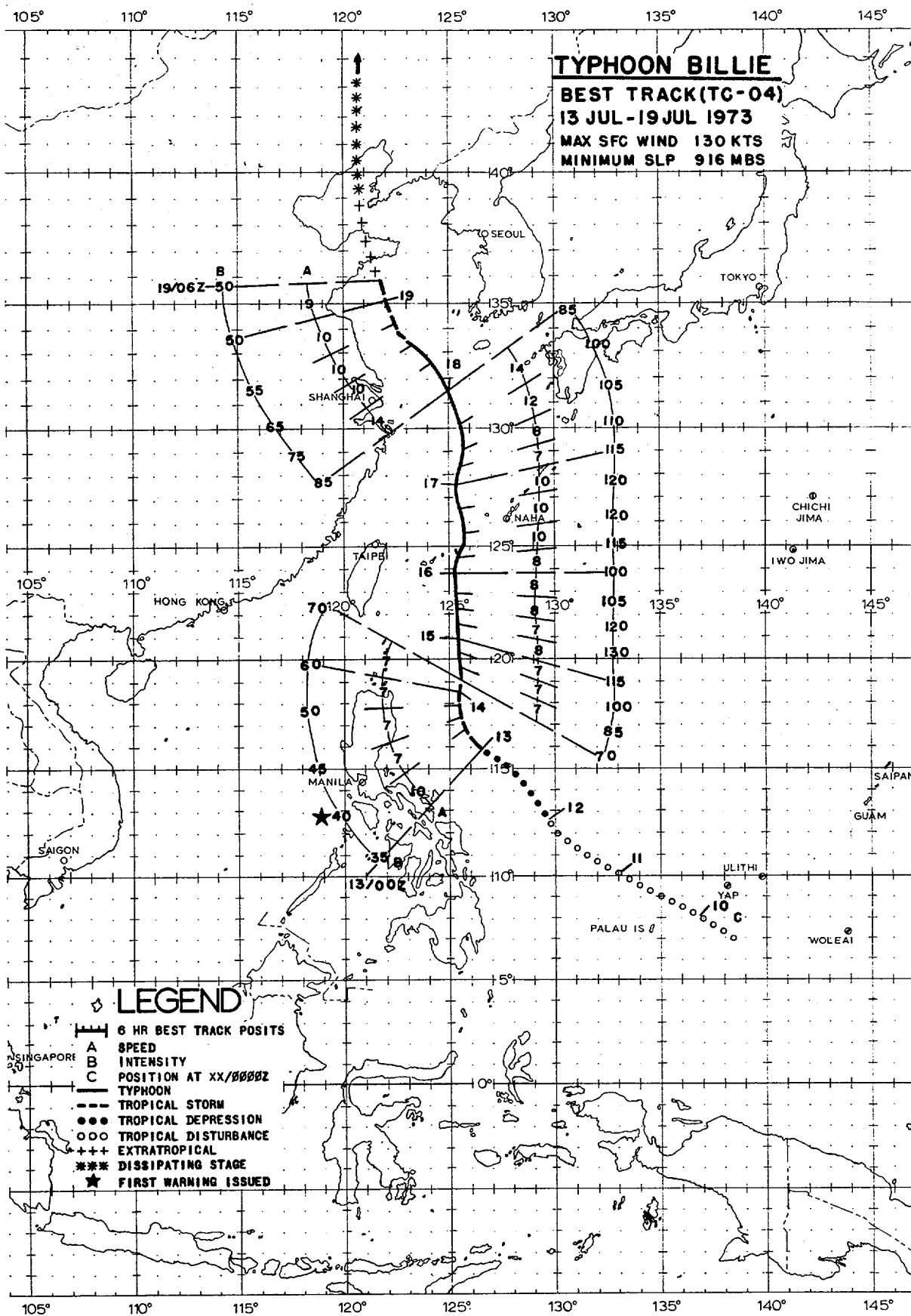


FIGURE 4-4. *Typhoon Anita in the Gulf of Tonkin near peak intensity, 8 July 1973, 0432 GMT. (DMSP imagery)*



BILLIE

Billie, the season's first super typhoon, became a tropical depression in the western Philippine Sea some 250nm east of Luzon on 12 July. Her early history can be traced to the Yap-Palau area on 10 July as a weak circulation in the monsoon trough.

Billie initially tracked westward, gradually shifting to the northwest in response to a long wave, mid-tropospheric trough over eastern China. Reaching tropical storm force late on the 13th, Billie assumed a northerly course at a speed of 7 kts.

The long wave trough remained stationary, influencing Billie to maintain a meridional track at about 8 kts. Her center never deviated more than 30nm either side of 125.5E for 4 days, covering a distance of 720nm. This steadiness in direction for such an extended period of time sets Billie apart from any other northward moving typhoon during the period 1947-1972.

Rapid deepening occurred once typhoon force was attained early on the 14th as Billie's central pressure fell 50mb in 24 hours. At 15/0330 GMT, aircraft reconnaissance indicated that the central pressure had dropped to 916mb within a tightly organized eye 8nm in diameter (Figure 4-5).

Billie's central pressure rose to 954mb during the next 18 hours as she approached the Ryukyus. Commencing an unusual second deepening as she crossed through the island chain, Billie's central pressure dropped to 917mb in the East China Sea (16/1154 GMT).

Billie passed just east of Miyako Jima, where maximum sustained winds of 65 kts with gusts to 104 kts were recorded (16/

0700 GMT). The lowest pressure reading at the Japanese Meteorological Agency Station was 947.5mb (16/0650 GMT).

The island of Okinawa experienced gale force winds as Billie transited northward through the East China Sea. Naha registered maximum sustained winds of 35 kts with gusts to 58 kts (16/1700 GMT) while White Beach Naval Port Facility recorded 45 kts sustained with gusts to 55 kts (16/1900 GMT). Kadena AFB reported lesser winds of 28 kts (16/1640 GMT) with gusts of 43 kts (16/1354 GMT). Based on land radar, Billie's eye passed 105nm west of Okinawa at 16/1800 GMT.

On the 17th, a short wave deepened the northern portion of the long wave trough situated in the Lake Baikal region of Siberia, causing increased ridging over Manchuria and the Sea of Japan. This ridging prevented Billie from recurving. On the 18th, Billie shifted to a northwest course 120nm southsouthwest of Cheju-do Island. Satellite imagery indicated drier air off the Asian Mainland was entering Billie's circulation at this time. She weakened significantly during the 18th, dropping to tropical storm strength late that day while tracking into the Yellow Sea.

Approaching the Gulf of Chihli on the 19th, Billie acquired extratropical characteristics and accelerated to a forward speed greater than 20 kts. Billie finally moved inland near Chin-Chow China and dissipated on the 20th.

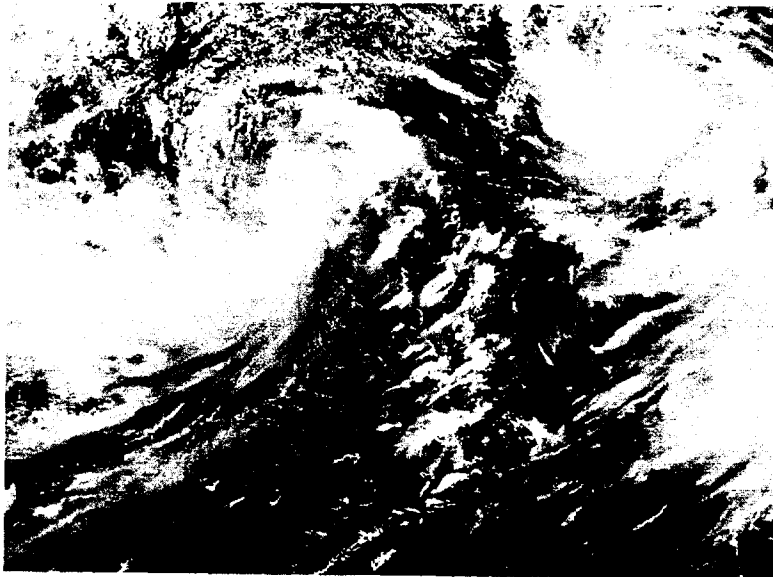
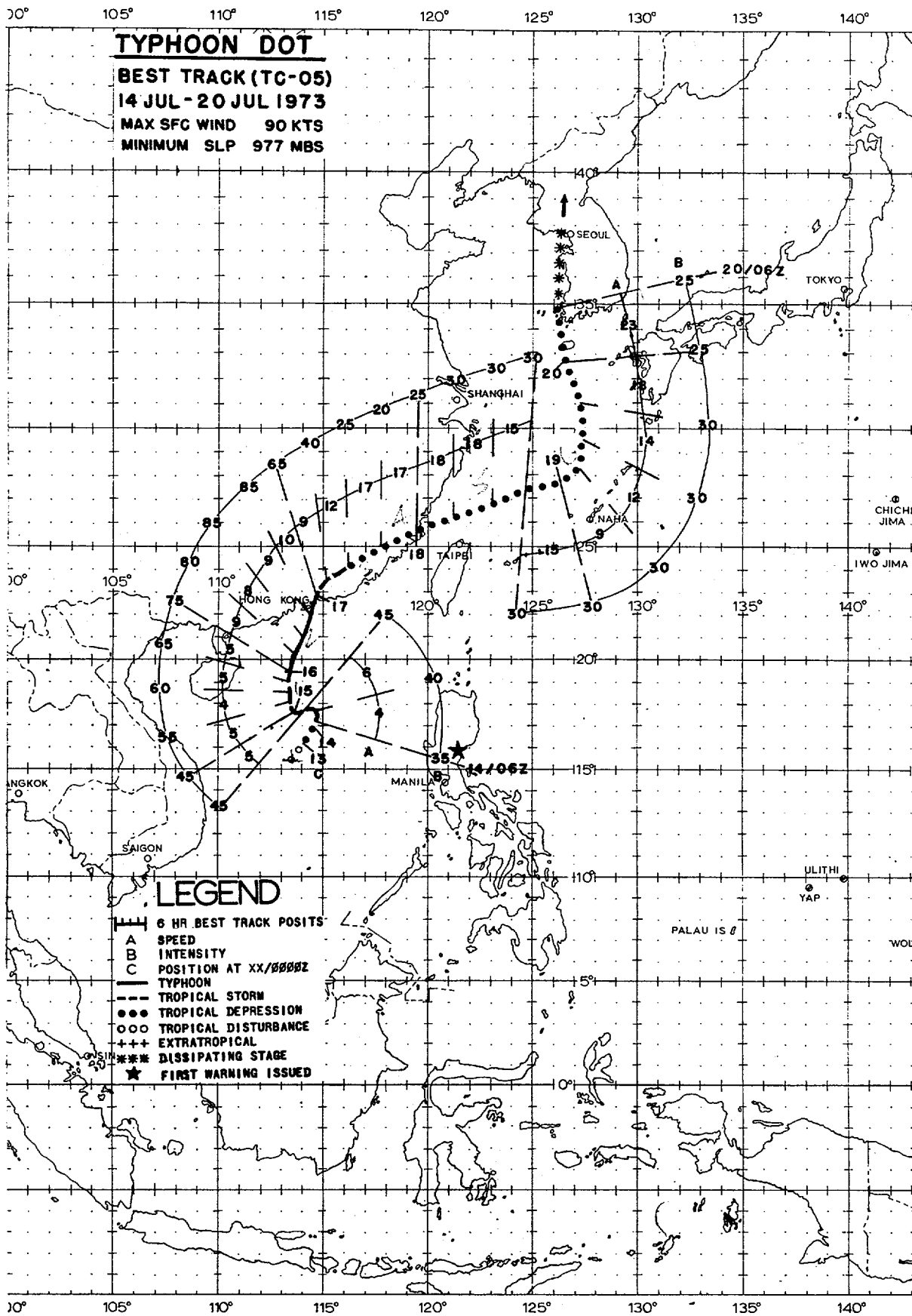


FIGURE 4-5. Typhoon Billie (right) 7 hours prior to an unusual second deepening 190 nm east of Taiwan. Typhoon Dot (left) in the South China Sea, 16 July 1973, 0416 GMT. (DMSP Imagery)



The South China Sea spawned its second typhoon of the 1973 season on 13 July with the genesis of Dot. Her development was quite similar to Anita's. A surge in the low level southwesterlies preceded her formation in the monsoonal trough.

Dot formed a few days after Billie. While Billie intensified rapidly in the Philippine Sea to dominate the synoptic situation in the vicinity of both tropical cyclones, Dot drifted slowly northward remaining poorly organized (Figure 4-6). Billie's strong mass divergence aloft effectively blocked Dot's outflow to the subtropical westerlies leaving a good outflow channel only in the southwest semicircle. This may have been a critical factor in explaining Dot's slow rate of intensification during the first three days of her existence.

Late on the 15th, Dot began to increase her rate of intensification. The United Kingdom ship HYRIA, located 60 nautical miles southeast of Dot's center, observed 55 knots of wind and a pressure of 989.3mb (15/0600 GMT). She reached typhoon strength late that evening as she accelerated to a speed of 9 knots towards Hong Kong. During this period, the separation between Dot and Billie began to increase and Billie had reached peak intensity and was starting to weaken. This apparently allowed Dot to intensify at a faster rate.

Besides intensity interaction between Dot and Billie, both storms also experienced the Fujiwhara interaction (Figure 4-7). By subtracting the steering flow from the resultant movement of both storms the interaction is quite pronounced (Brand, 1968). Throughout the period of the interaction Billie remained the stronger of the

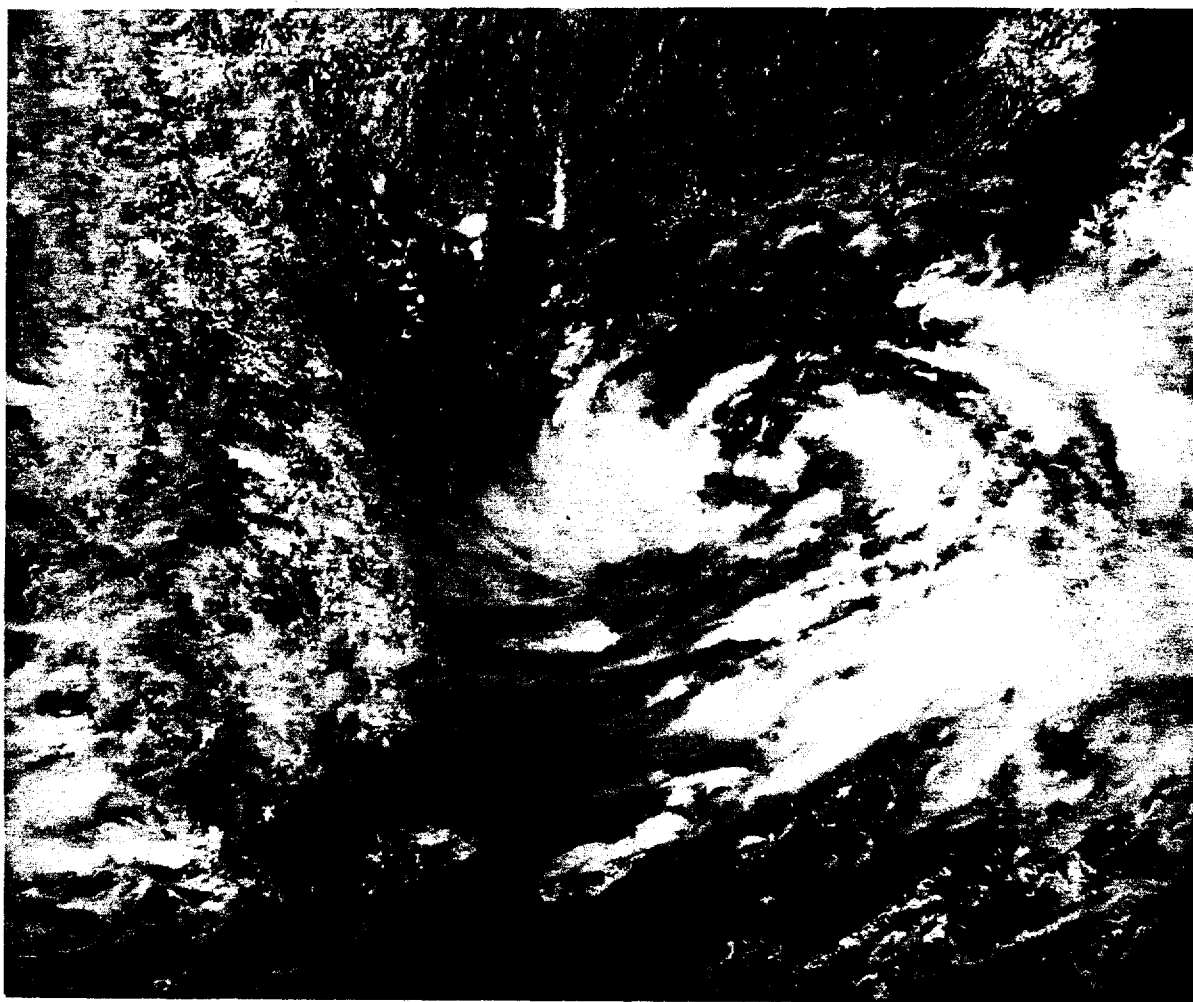


FIGURE 4-6. Dot as a tropical depression in the South China Sea, 14 July 1973, 0446 GMT. (DMSP imagery)

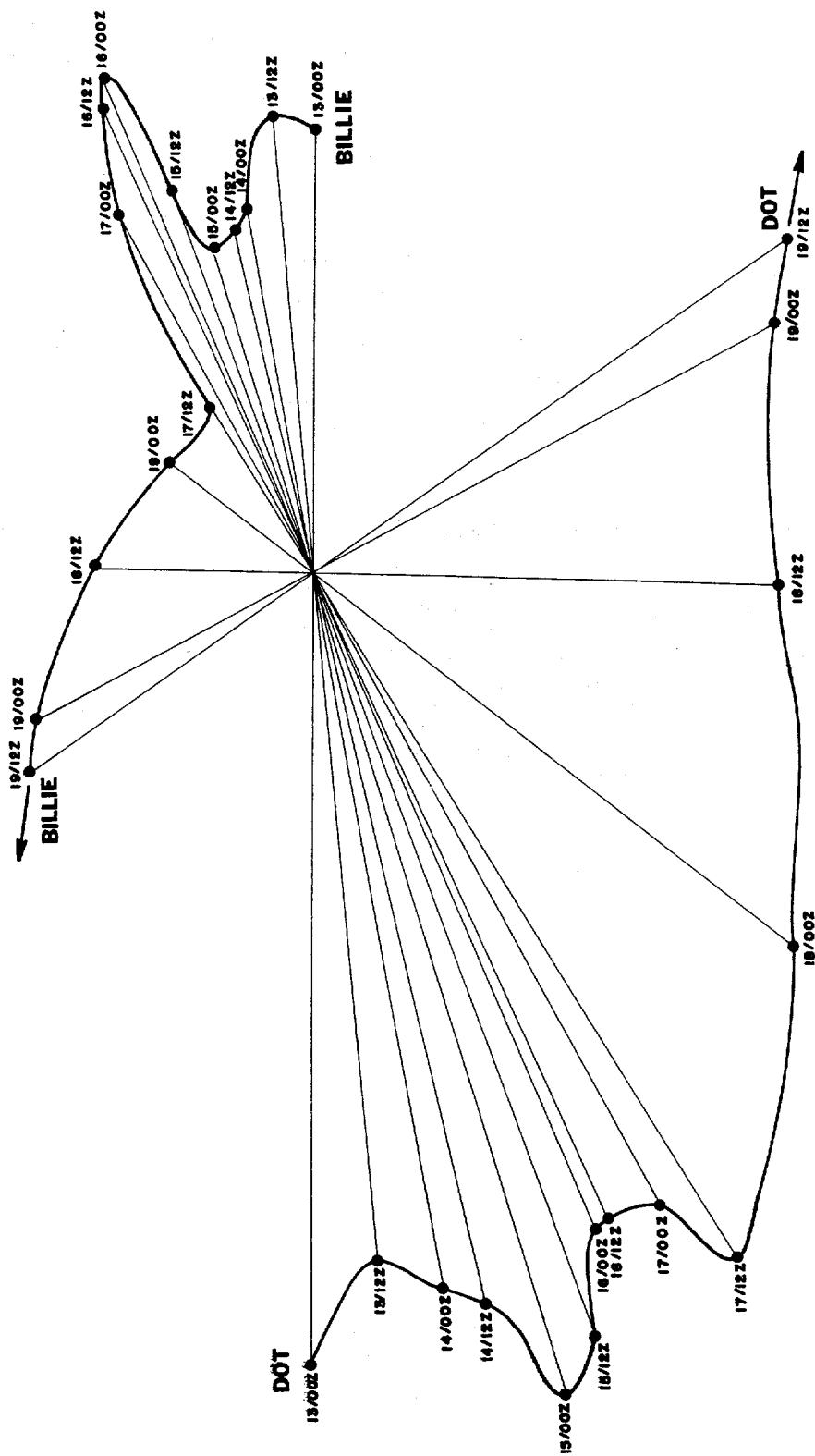


FIGURE 4-7. Depicts Fujiwhara interaction between Typhoon Dot and Typhoon Billie over a period of approximately 6 1/2 days.

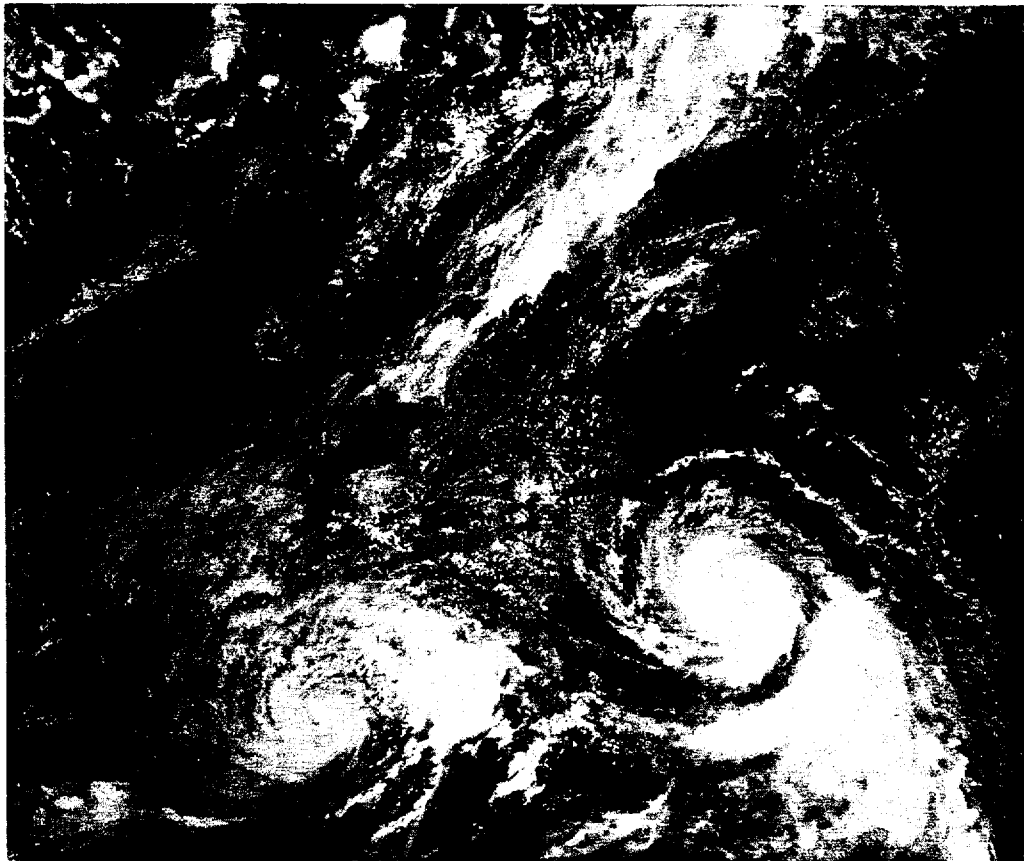


FIGURE 4-8. Dot (left) overland 70 nm northeast of Hong Kong and Typhoon Billie (right) in the East China Sea, 17 July 1973, 0402 GMT. (DMSP imagery)

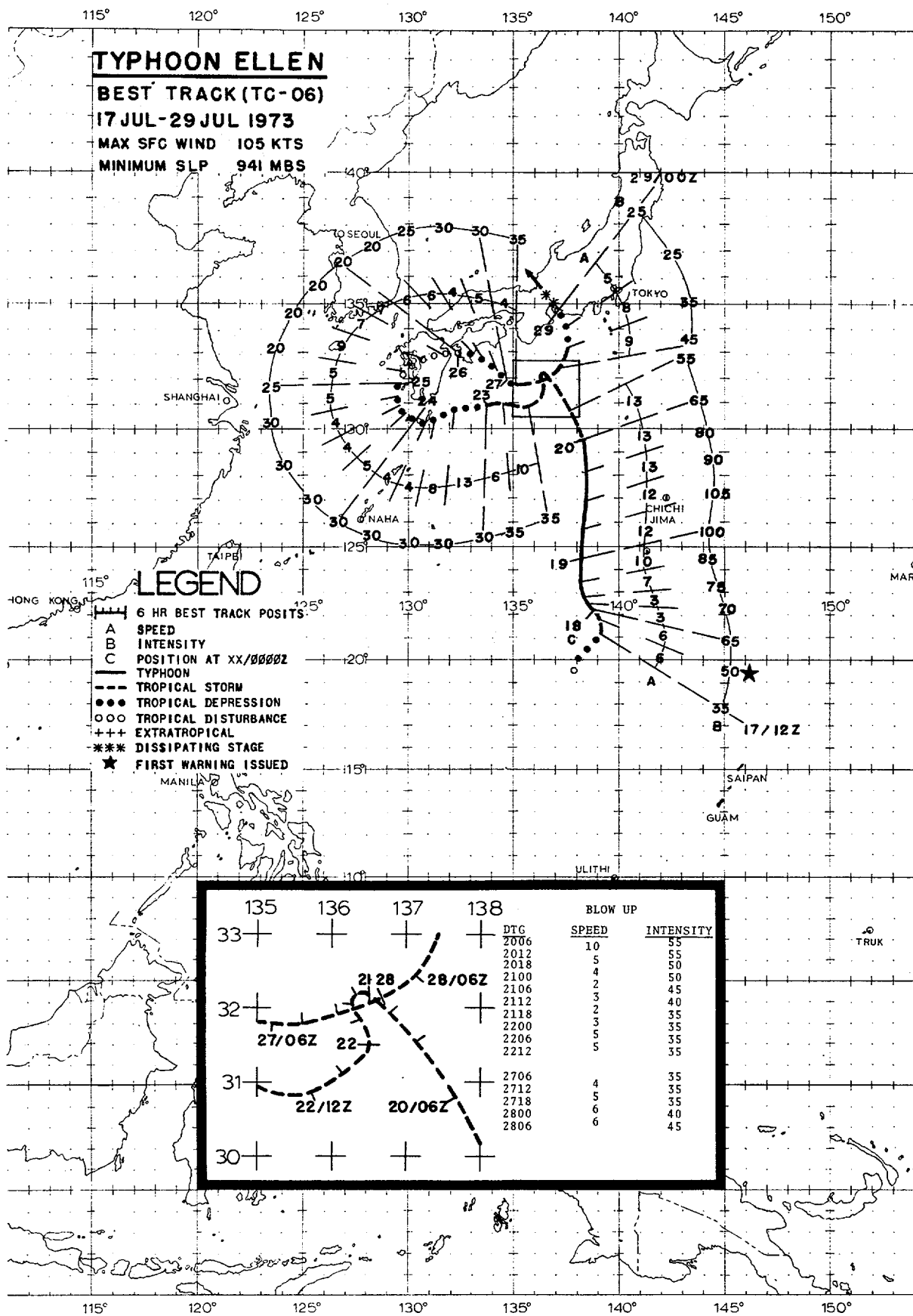
two. As a result, Dot's resultant movement was affected much more significantly. Both storms rotated 124 degrees around the common center of rotation.

Dot reached her peak intensity of 85 knots on the 16th, about 80nm south of Hong Kong. She passed within 12 miles of the Royal Observatory in Hong Kong which experienced maximum sustained winds of 32 knots with a peak gust of 76 knots. Tate's Cairn in the Colony reported the strongest sustained winds of 57 knots with peak gusts of 97 knots.

Dot weakened considerably upon making landfall on the northeastern side of Mirs Bay (Figure 4-8). She tracked toward the eastnortheast over eastern Kwangtung during the night of the 17th as a low pressure area and entered the East China Sea near Foochow as a tropical depression on the morning of the 18th. As Dot approached within 120nm northnorthwest of Okinawa, she took an abrupt change of course due north in response to a building ridge to the east and accelerated rapidly, following in the wake of Billie. Dot dissipated over the Yellow Sea on the 20th.

Damage reports from Hong Kong indicated many low-lying areas in the New Territories were flooded. Hong Kong experienced heavy losses to garden crops, fruit trees, livestock, and farm houses. A landslide killed one person and injured

38 others. Two freighters were beached and six others dragged anchor.



The first indication of what was to become Ellen appeared in the surface data on 15 July as an increased troughing in the extensive convergence zone southeast of Typhoon Billie. By 17 July, high resolution DMSP satellite imagery confirmed the existence of a closed circulation in the trough near 20°N 138°E (Figure 4-9).

Ellen evolved unusually far north in the trailing convergence area of Typhoon Billie. Furthermore, in the early stages of development, the upper tropospheric outflow was most obviously influenced by the TUTT. Post-analysis of 200mb synoptic charts and satellite data indicates that the formation was assisted by a small, but pronounced, ridging induced on the east side of a westward moving cell in the upper tropospheric trough.

Ellen intensified rapidly, reaching typhoon strength by the 18th. Iwo Jima (Japanese Maritime Self Defense Force) reported southeasterlies with maximum gust of 44 knots as she passed to the west within 165nm (19/0200 GMT). Ellen achieved peak intensity as a reconnaissance aircraft observed maximum winds of 105 knots and a central pressure of 941mb (19/0420 GMT).

During the early portion of her life, Ellen tracked almost due north as Billie had done. She moved to the north beneath upper tropospheric northerly flow (35-40 knots). By late on the 19th, the strong vertical shearing environment caused her to deteriorate rapidly over open water (Figure

4-10). By the 20th, the upper level anticyclone over Ellen had sheared off exposing her low level circulation. Convective activity at this time was confined to convergence areas well south and southeast of the center.

As a weak low-level circulation, the remains of Ellen drifted westward under the influence of the troughing left by Billie and Dot and a quasi-stationary anticyclone over the Sea of Japan. Satellite imagery on 23 July indicated a rejuvenation of convection over the circulation which then persisted through 28 July with varying degrees of intensity. Reconnaissance aircraft on 24 July confirmed the presence of a warm core, closed circulation. As a result of the weak steering flow, Ellen's movement was erratic during the period from the 21st to the 28th.

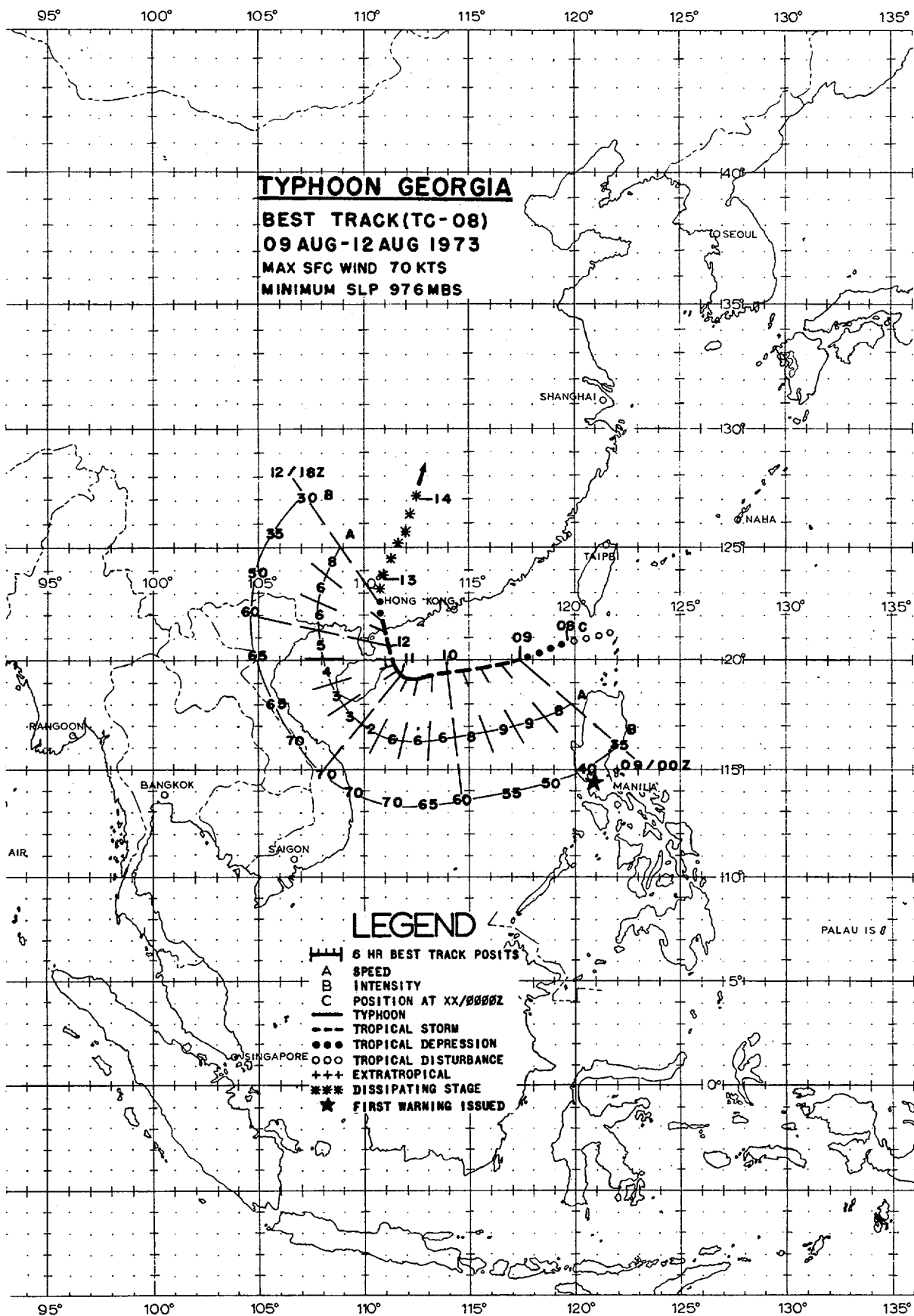
On the 28th, she reintensified once more 90nm from the south coast of Honshu. The Japanese weather ship OJKA and two other ships reported winds of 30 to 35 knots around Ellen (28/0000Z). She reached a peak of 45 knots as a shortwave trough over the Sea of Japan caused her to move on a northward course over south central Japan dissipating over land on the 29th.



FIGURE 4-9. Formative stages of Ellen centered 300 nm southwest of Iwo Jima, 17 July 1973, 0221 GMT. (DMSP imagery)



FIGURE 4-10. Typhoon Ellen (right) at peak intensity. Dot (left) as a tropical depression, 19 July 1973, 0333 GMT. (DMSP imagery)



GEORGIA

During early August, the tropical upper tropospheric trough (TUTT) remained to the north of and in close proximity to the monsoon trough in the South China Sea. As a result, Georgia's formation and subsequent development cannot be easily attributed to the monsoon trough or the TUTT independently, but more as an interaction between the two. Sadler (1973) suggests that westward moving cells in the TUTT provide an upper level westerly outflow channel which enhances development of disturbances in the monsoon trough. This type of influence was apparent during the development of Georgia.

Georgia reached minimum tropical storm intensity on 9 August as she transited on a westsouthwest course across the South China Sea at a moderate speed. She passed within 170nm of Hong Kong late on the 9th. Maximum sustained winds experienced at Hong Kong were 41 knots with a peak gust of

73 knots. Georgia reached typhoon intensity on 10 August (Figure 4-11).

Maintaining her westerly track at 8 knots until early on the 11th, Georgia then turned north in response to a weakness in the high cell over eastern China. She made landfall north of Hainan Island on 12 August and dissipated over China. Georgia was the third tropical cyclone originating in the South China Sea to reach typhoon intensity in 1973.

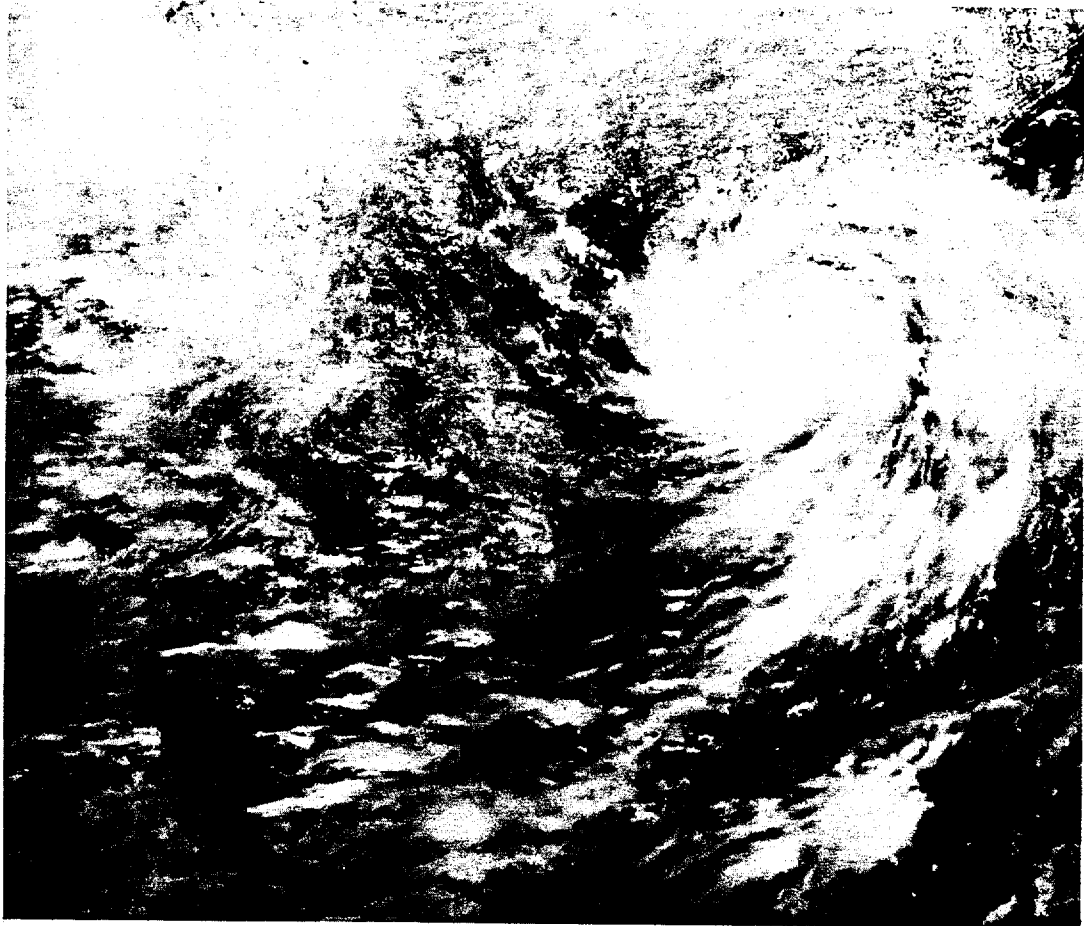
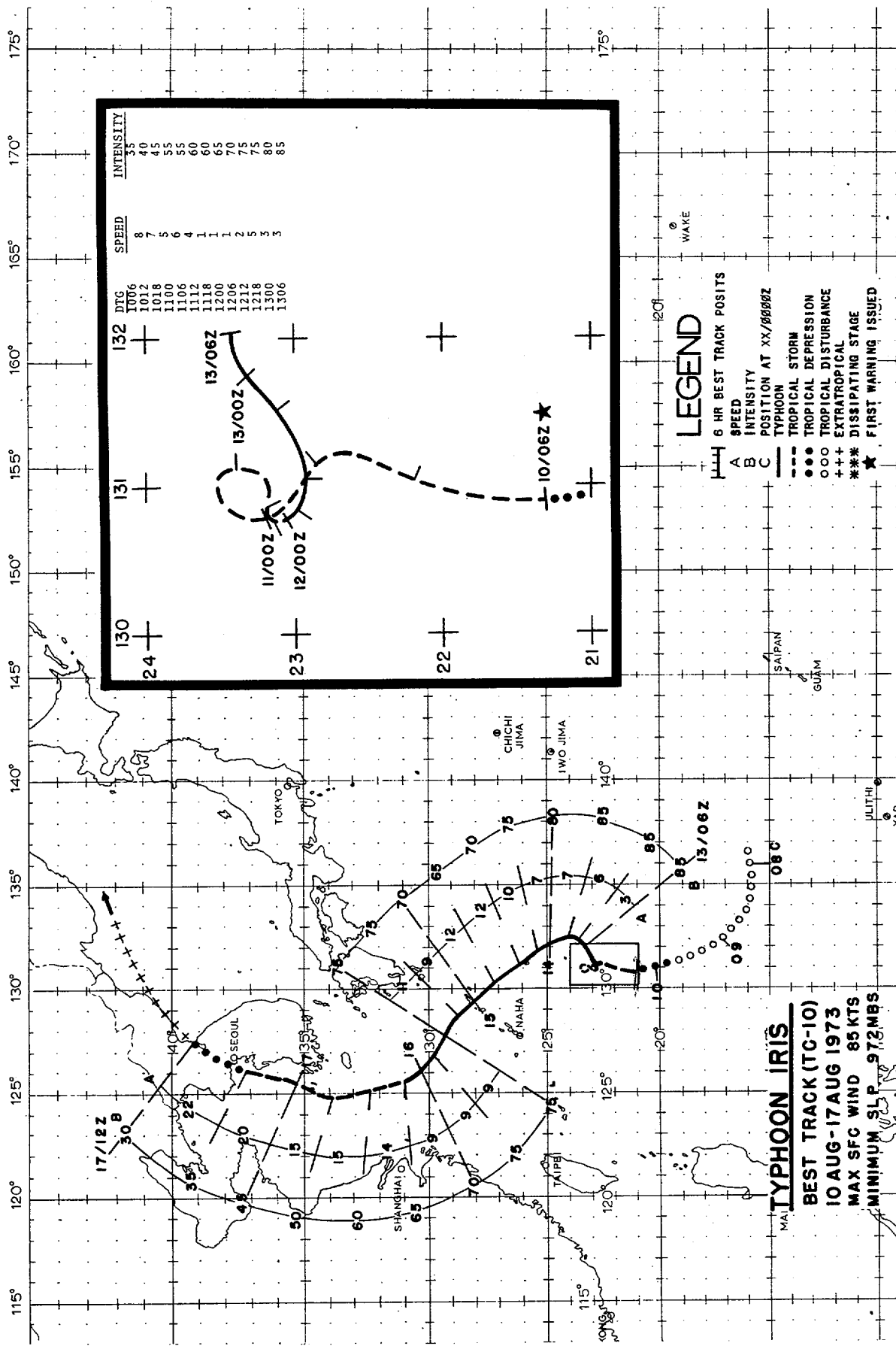


FIGURE 4-11. Typhoon Georgia in the South China Sea 140 nm east of Hainan Island, 10 August 1973, 0500 GMT. [DMSP imagery]



On the 8th of August, the monsoon trough extended 1500 nautical miles southeast from the Luzon Strait to a position just west of Truk with a weak surface cyclonic circulation imbedded in the trough 420 nautical miles north of Yap. Only 24 hours previously, its eastward extent had been restricted to the northern part of the South China Sea.

During the next two days, the disturbance drifted northwestward with little development. By the 10th, the disturbance had intensified to Tropical Storm Iris. She continued to move northward at 8 knots.

On the morning of the 11th, the complex upper air and weak steering flow patterns resulting from the presence of the subtropical ridge to the north and the near equatorial ridge to the south of Iris forced her to remain essentially quasi-stationary for the next 48 hours. However, she continued to intensify during this period and by early on the 12th, developed typhoon strength winds.

Early on the 13th, Iris began to move toward the northeast under the influence of the near equatorial ridge reaching her maximum intensity of 85 knots that afternoon (Figure 4-12).

As Hope dissipated to the east, the subtropical ridge returned to its climatological position and the near equatorial ridge weakened. This forced Iris to alter her course to the northwest on the 14th in

response to the change in the steering flow. The Japanese meteorological station at Minami Daito Jima measured a minimum pressure of 974.7mb during the passage of Iris (14/0707 GMT). Approximately 11 1/2 hours (1830 GMT) after passage of the surface center, the station reported peak gusts of 63 knots out of the southwest. She gradually weakened to minimum typhoon intensity prior to crossing the island of Amami O-Shima. Two fishing vessels were reported lost in the vicinity of the island during her passage.

After crossing the island she reintensified briefly to 75 knots. By the 16th, Iris weakened to tropical storm force and took a more northerly course (Figure 4-13).

On the morning of the 17th, Iris began recurving. Kunsan Air Base in the Republic of Korea experienced maximum sustained winds of 46 knots with a peak gust of 64 knots as Iris passed within 25nm (17/0646 GMT). She made landfall near Kaesong, Korea about 17/0800 GMT with maximum winds of 35 knots. Iris continued across Korea, entering the Sea of Japan near Wonsan where the maximum winds were still 30 knots. She became extratropical over the Sea of Japan as she merged with a front moving off Manchuria.

Initial reports from Korea indicated two persons were killed, three missing and hundreds were left homeless. A barge carrying six persons sank in the sea off Kijang - Myon, Yangsangun; 3 were rescued.

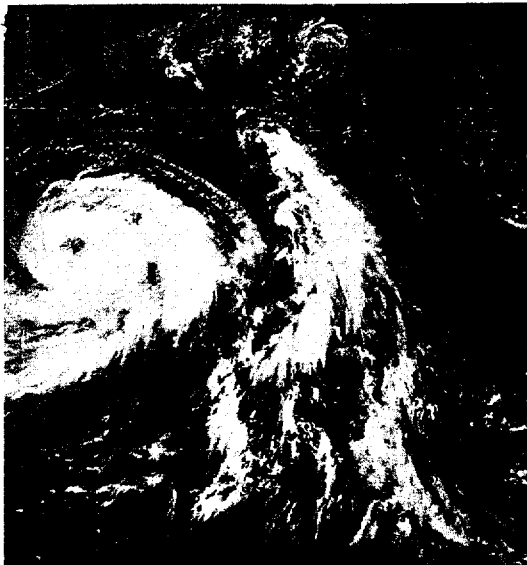


FIGURE 4-12. Typhoon Iris (left) near peak intensity 285 nm southeast of Okinawa. Remnants of Hope (right) just off the coast of Honshu, 13 August 1973, 0234 GMT. [DMSP imagery]

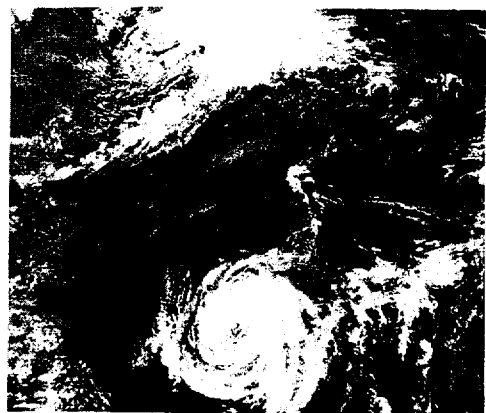
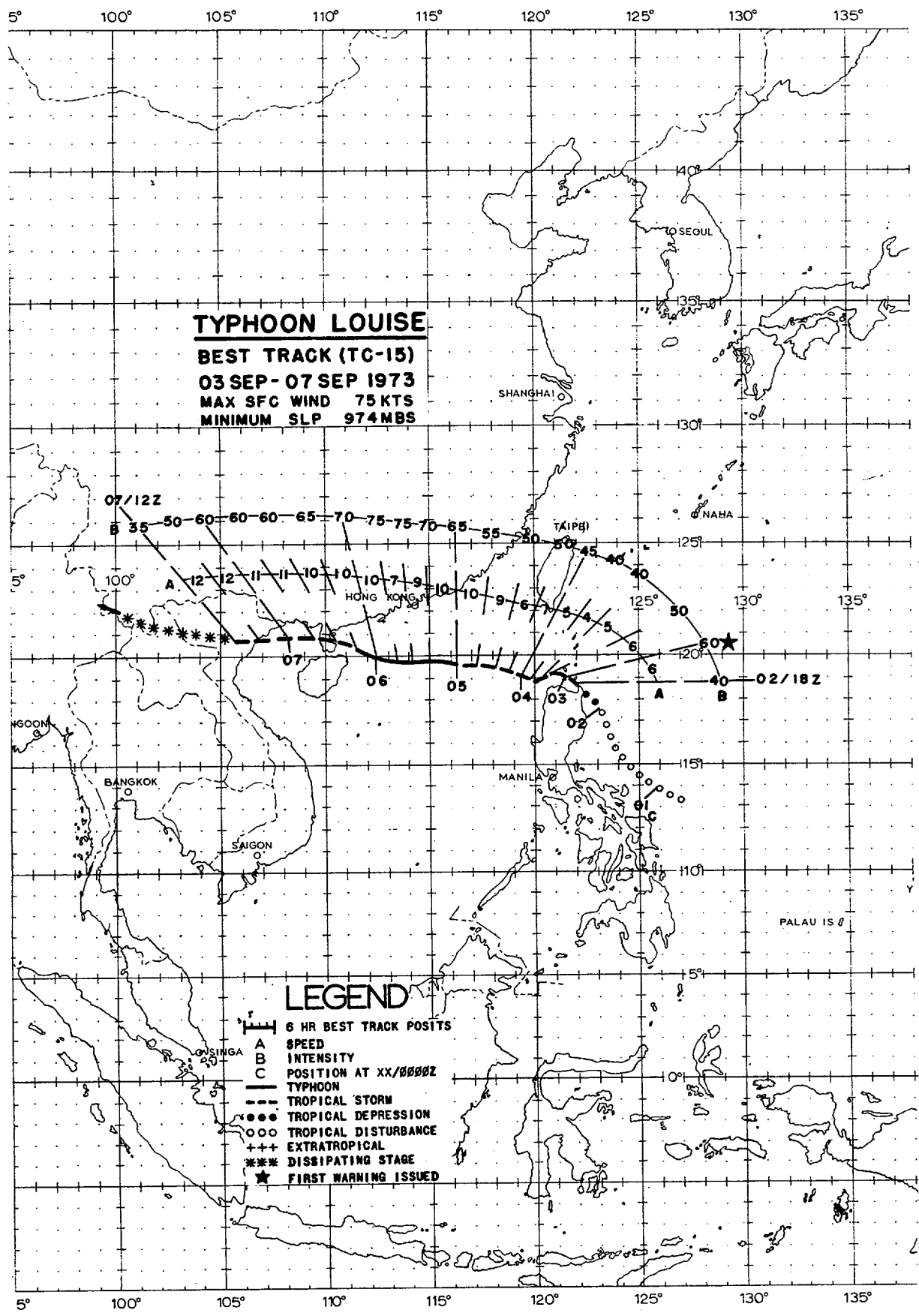


FIGURE 4-13. Typhoon Iris 165 nm south of Cheju Do, 16 August 1973, 0332 GMT. [DMSP imagery]



LOUISE

Louise began as a low level circulation in the monsoon trough first noted on 30 August in the Philippine Sea to the east of Catanduanes Island. An organized cloud pattern became apparent the next day but the surface circulation remained weak. The weak surface low drifted towards the northwest for the next 72 hours.

By 3 September, an aircraft investigative mission reported a narrow band of 65 to 75 knot surface winds north of the low center although the minimum sea level pressure was only 998mb (03/0350 GMT). A 60 knot wind report from the United Kingdom ship SHEAF TYNE 30nm to the north of Louise confirmed the aircraft observation. Satellite imagery at approximately the same time showed Louise to be poorly organized. The near-typhoon force winds appear to have been a transitory phenomenon induced by the channeling effect of the Luzon Strait. By the evening of the 3rd, a reconnaissance

aircraft reported maximum winds of only 40 knots as Louise entered the South China Sea.

On the 4th, Louise had become a better organized tropical storm well on her way to becoming a typhoon (Figure 4-14). The mid-tropospheric ridge to the north of Louise kept her on a westerly course at 10 kts across the South China Sea.

She passed 150nm to the south of Hong Kong late on the 5th just as she reached peak intensity of 75 kts. Throughout her life, Louise remained a relatively small typhoon. Louise crossed the Luichow Peninsula during the night of the 6th. Eighteen hours later she made landfall and dissipated rapidly over North Vietnam.

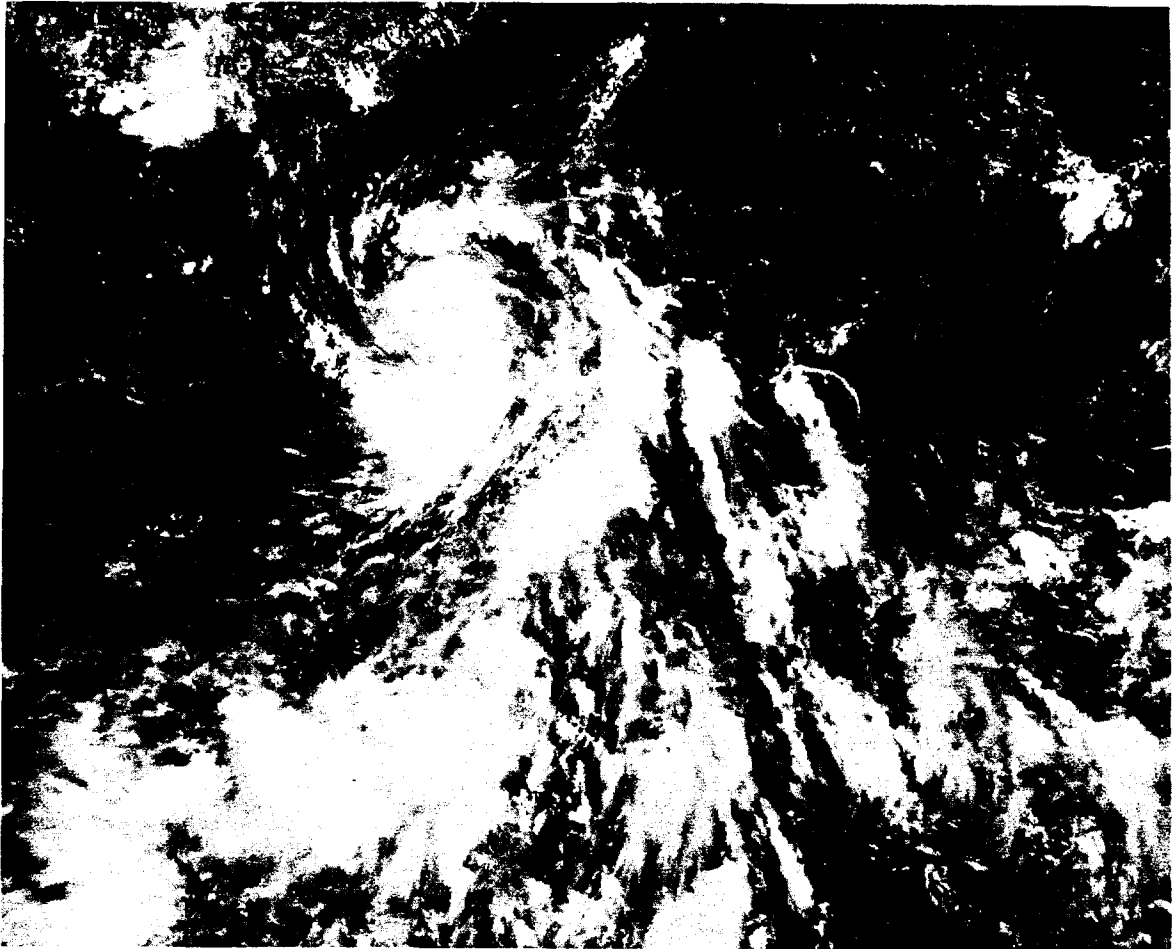
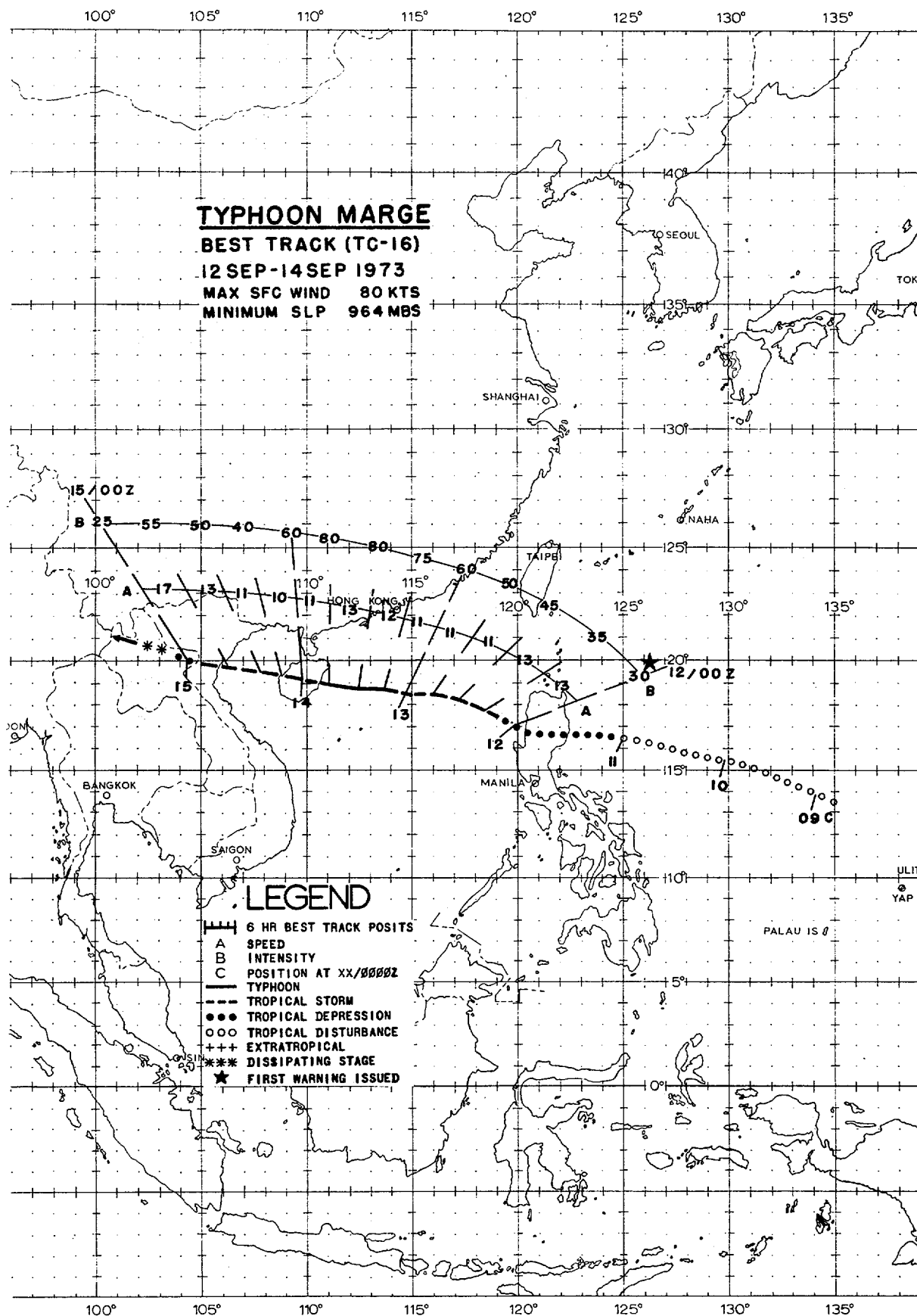


FIGURE 4-14. Tropical Storm Louise 105 nm northwest of Luzon, 4 September 1973, 0401 GMT. (DMSP imagery)



Marge entered the South China Sea on 12 September as a tropical depression, after crossing northern Luzon (Figure 4-15). She quickly developed to tropical storm strength 125 nm northwest of Cape Bolinao. The early stages of Marge can be traced to a weak circulation in the monsoon trough appearing on the synoptic surface analysis 750 miles eastsoutheast of Luzon (08/0000 GMT). This system tracked westward during the next four days as it accelerated to a speed of 11 to 12 knots before making landfall on northern Luzon.

A narrow, mid-tropospheric, subtropical ridge was positioned over southern China as Marge emerged into the South China Sea. Little change in intensity or orientation of the ridge occurred during the next few days, dictating a westerly course which eventually caused Marge to strike North Vietnam 2 1/2 days later.

Maintaining a forward speed of 11 knots, Marge intensified steadily after entering the open waters of the South China Sea, reaching typhoon force as she

passed 200 nm south of Hong Kong on the morning of the 13th (Figure 4-16). The minimum measured central pressure by aircraft reconnaissance, prior to the typhoon crossing the no-fly line, was 964 mb early in the evening of 13 September.

Striking central Hainan Island early on the morning of the 14th with sustained winds estimated near 80 knots, Marge emerged into the Gulf of Tonkin with tropical storm force some 12 hours later. Eventual landfall was made 60 nm north of Vinh, North Vietnam during the early morning hours of the 15th. Subsequently, Marge dissipated rapidly inland over the highlands of Laos.

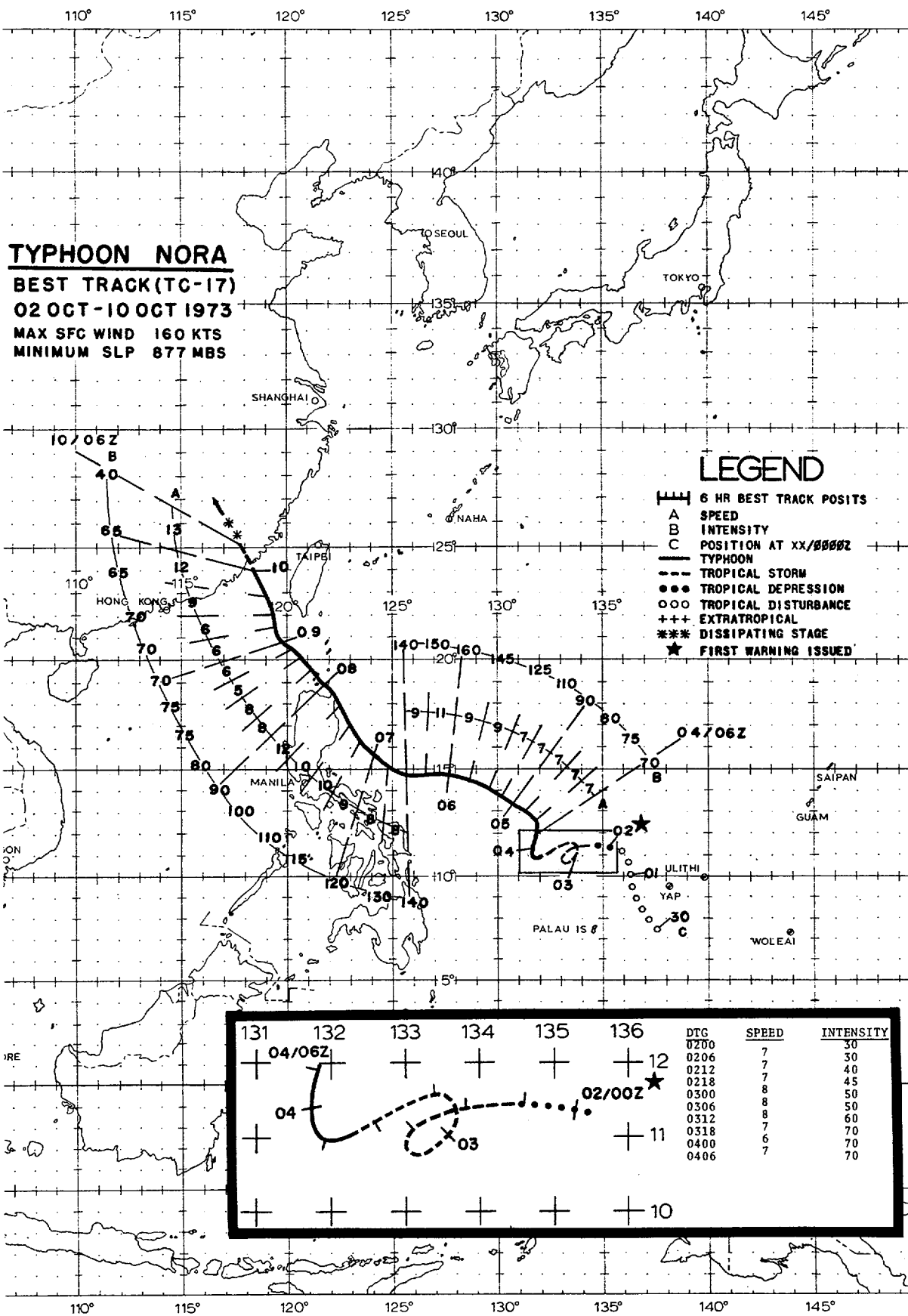
One interesting feature of Marge during her transit of the South China Sea was her small size. Similar to Louise, as a typhoon, her circulation did not appear to exceed 150 miles in diameter as evidenced by ship and aircraft reconnaissance data. Typhoon strength winds were probably confined to the wall cloud region.



FIGURE 4-15. Marge as a tropical depression 20 nm west of Luzon, 11 September 1973, 2342 GMT. (DMSP imagery)



FIGURE 4-16. Tropical Storm Marge near typhoon strength 225 nm south of Hong Kong, 13 September 1973, 0106 GMT. (DMSP imagery)



A weak surface low formed in the monsoon trough, 120 miles south of Yap, on 30 September, and drifted northwest for the next two days. By the evening of 2 October, the tropical disturbance had intensified to Tropical Storm Nora. Reconnaissance aircraft reported maximum flight level winds of 45 kts and a minimum sea level pressure of 987 mb.

Nora continued a gradual intensification until early on the afternoon of the 5th when her winds exceeded 100 kts. During the next 20 hours, as she moved westward at 9 kts toward the Republic of the Philippines, Nora's central pressure plummeted 66mb to 877mb with maximum surface winds of 160 kts (Figure 4-17). Her

central pressure ranked among the lowest on record (Jordon, 1961).

On the evening of the 6th, the high resolution DMSP infrared imagery revealed the typical anticyclonic outflow pattern in the cirrus. The infrared data was then "thresholded" to display only the colder portion of the infrared spectrum sensed by the radiometer (Figure 4-18). It revealed what appeared to be a tightly wound band spiraling out from the eye wall. Nora was a super typhoon at this time with estimated maximum winds of 140 kts.

When Nora was 225 miles east of Manila on the morning of the 6th, she took a more northwesterly track in response to an

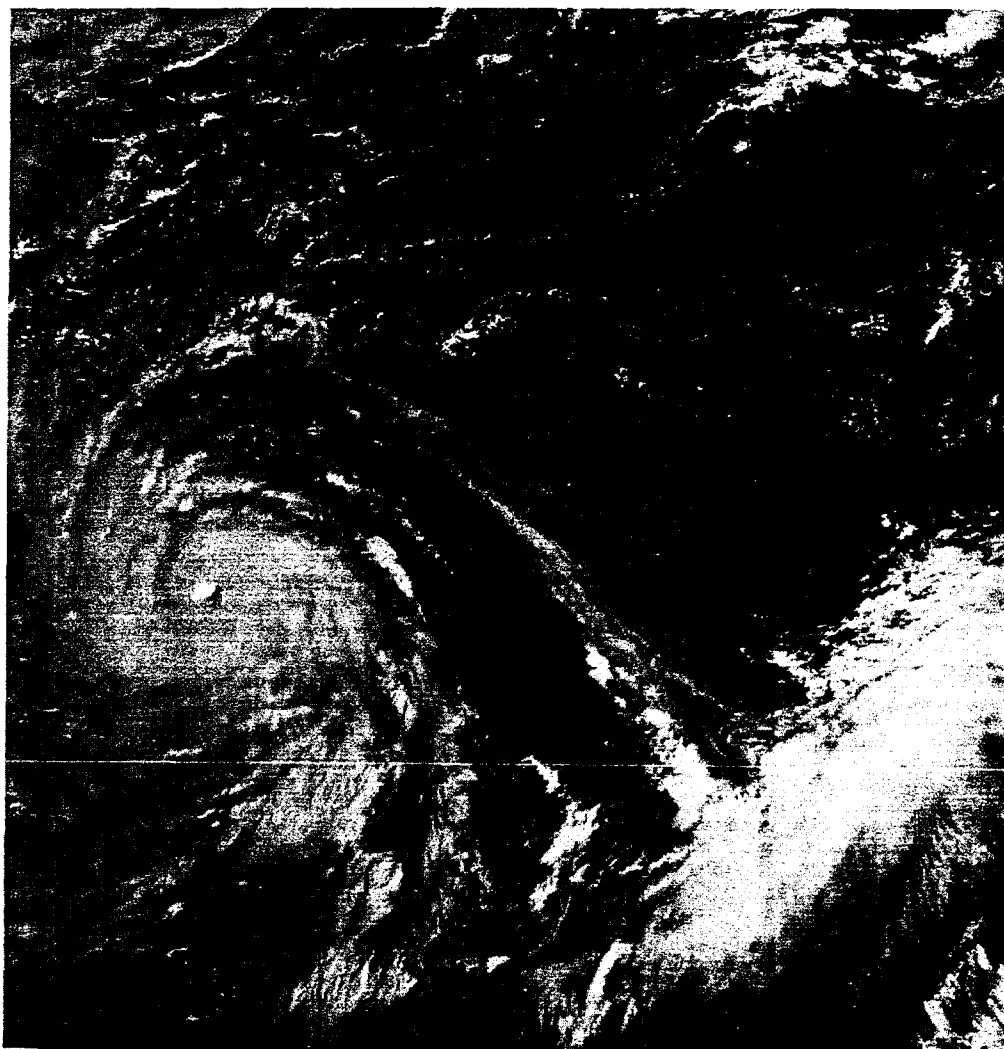


FIGURE 4-17. Super Typhoon Nora (left) at peak intensity 200 nm eastnortheast of Catanduanes Island. Formative stages of Patsy (right) with low level circulation center exposed, 5 October 1973, 2312 GMT. (DMSP imagery)

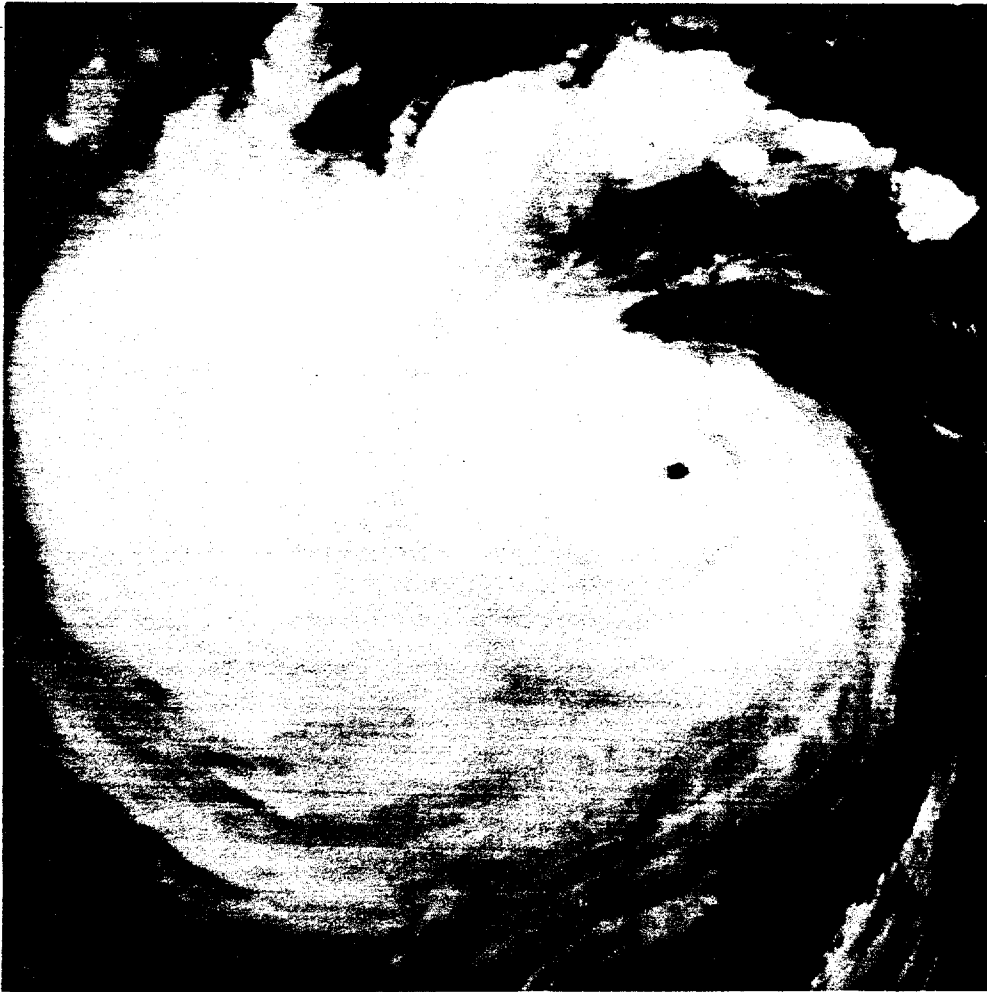


FIGURE 4-18. Thresholded infrared imagery of Nora displaying only the colder portion of the infrared spectrum sensed by the radiometer, 6 October 1973, 1153 GMT. (DMSP imagery)

approaching shortwave trough over China. Nora skirted the northeast tip of Luzon with maximum sustained winds of 100 kts and weakening.

As she transited the Luzon Strait on the 8th a dramatic rescue operation was occurring in the Taiwan Strait. In thirty foot seas and 50 kt winds, the Missile Frigate USS WORDEN rescued seven fishermen aboard the Taiwanese fishing vessel JAI TAI NR3 from the approaching typhoon. One Taiwanese crewman was lost at sea. The fishing vessel had been floundering in heavy seas with the forward section split lengthwise (Figure 4-19).

Nora passed within 60nm of Kaohsiung, Taiwan as she accelerated to a speed of 12 kts toward the northwest. She made landfall near Amoy in southern China on the morning of the 10th and degenerated into a low pressure area.

Luzon in the Republic of the Philippines suffered considerable damage. It was reported that 6 persons were killed and over a hundred thousand people were left homeless. Estimates of over \$2 million in

damage to crops, public and private property were reported. A Philippine freighter ASIAN MARINER was reported sunk by Typhoon Nora in the Taiwan Straits. All 38 crew members were rescued. The Greek freighter BALTIC KLIF was also capsized and sunk by Nora some 80nm southwest of the Pescadores. Three of the crew were drowned with several missing and presumed lost. Taiwan also suffered extensive damage from Nora. Twelve persons were reported dead and 28 unaccounted for. Nearly 8,000 people were left homeless with Nora destroying over a thousand houses and damaging hundreds of others.

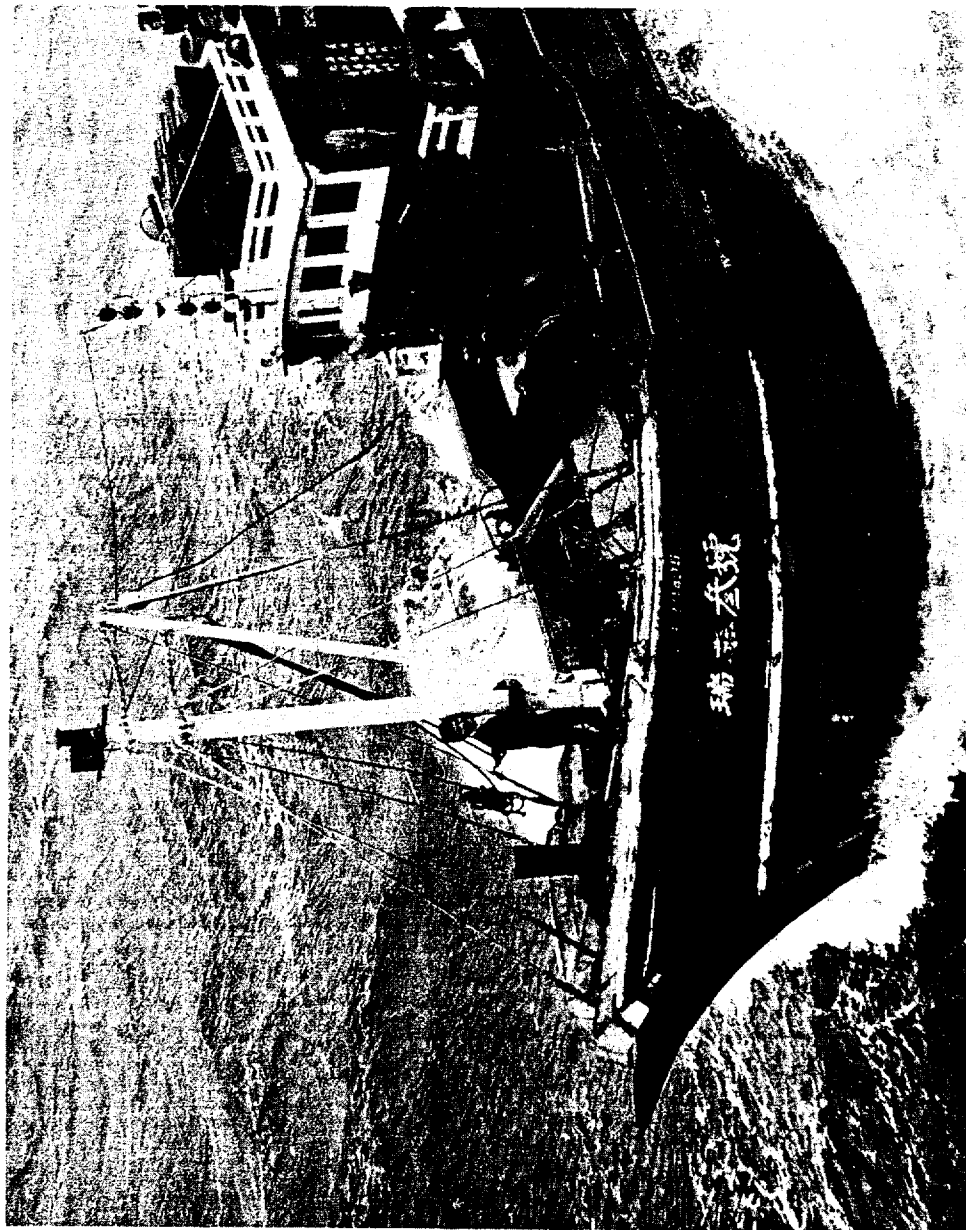
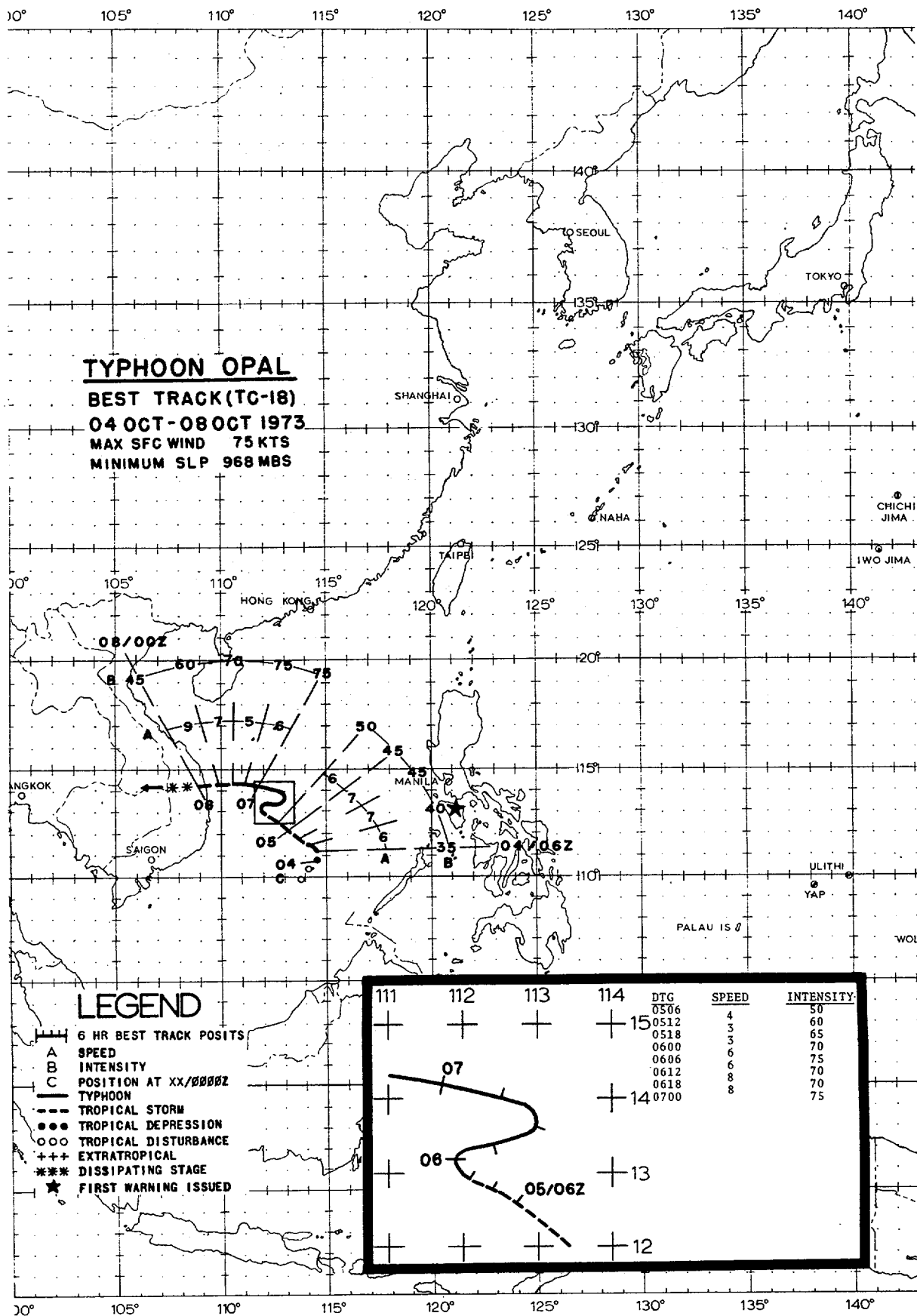


FIGURE 4-19. Fishing trawler JAI TAI NR. 3 floundering in high winds and heavy seas generated by Typhoon Noxa. -- U.S. Navy photo



Opal formed in an active monsoon trough in the South China Sea. The first evidence of a weak surface low appeared in the trough on the 1st of October. However, it wasn't until late on the 3rd that significant cloudiness associated with the incipient storm became apparent.

Early on 4 October, Opal reached minimal tropical storm intensity about 75 nm northwest of Nanshan Island. She moved to the northwest at 6 to 7 knots in response to the high pressure cell over eastern China. By the 5th, she had developed typhoon strength winds (Figure 4-20).

On the morning of the 6th, Opal abruptly changed her course and moved northeastward. She remained on this course for the next 12 hours before resuming a westnorthwesterly heading. A reasonable explanation for the temporary eastward movement may rest in a Fujiwhara interaction with typhoon Nora. Nora was positioned in the Philippine Sea about 750 nautical miles from Opal and

reached maximum intensity almost coincidentally with the eastward shift in Opal. Also, Nora turned to a more northerly track at this time. Brand (1968) reports a maximum distance for interaction of about 750 nautical miles. He demonstrates that the angular change rate of a line connecting the storms at this distance should be very small, only 3 degrees per 12 hours. The actual change was somewhat smaller, indicating the weakness of the interaction. The short period of the interaction may be due to the terrain effects of the intervening Republic of the Philippines, among other factors, as Brand suggests that the binary rotation is due to the circulation of the inflow layer which occupies only the lowest few thousand feet.

Maximum winds of 70 to 75 knots were observed during the 6th and early on the 7th as Opal resumed her westnorthwest movement. Opal moved ashore north of Qui Nhon, Republic of Vietnam late on 7 October and rapidly dissipated.

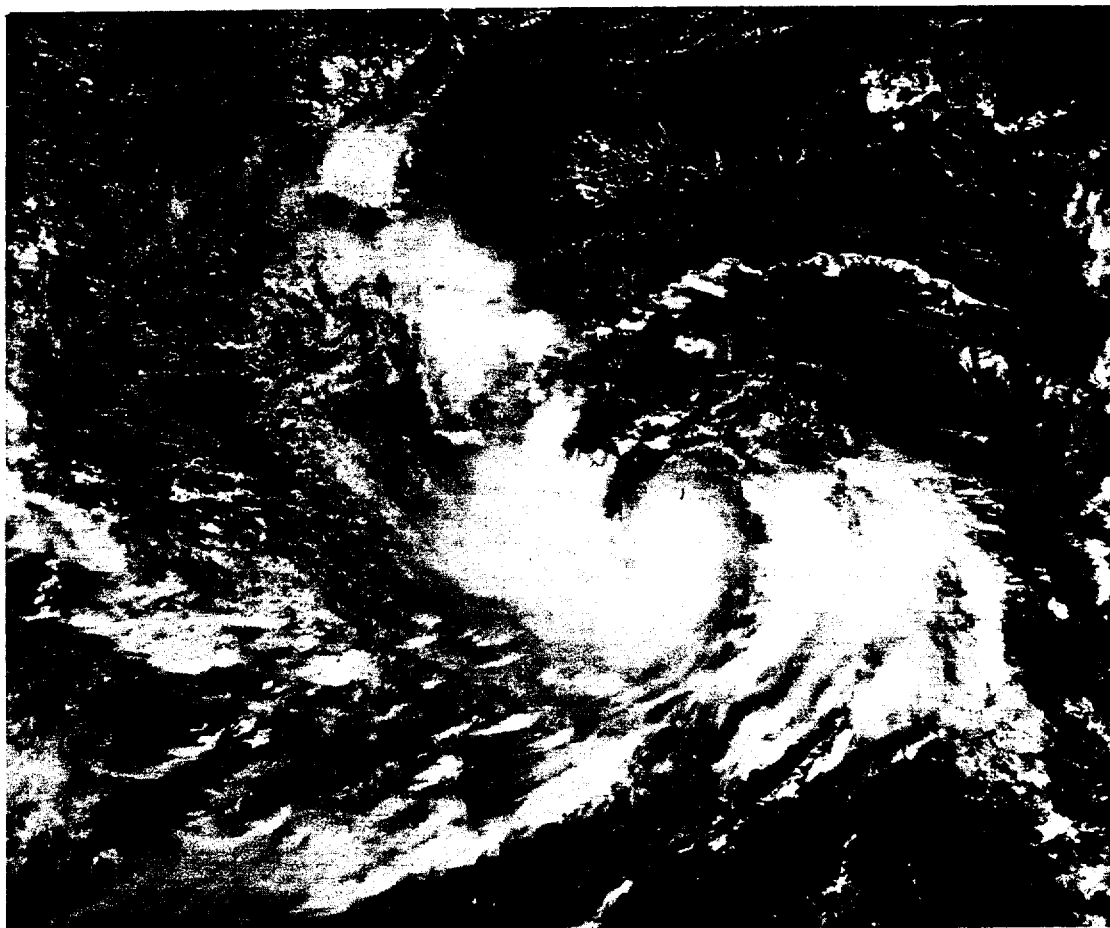


FIGURE 4-20. Tropical Storm Opal in the South China Sea 225 nm southeast of Qui Nhon, 5 October 1973, 0458 GMT. (DMSP imagery)

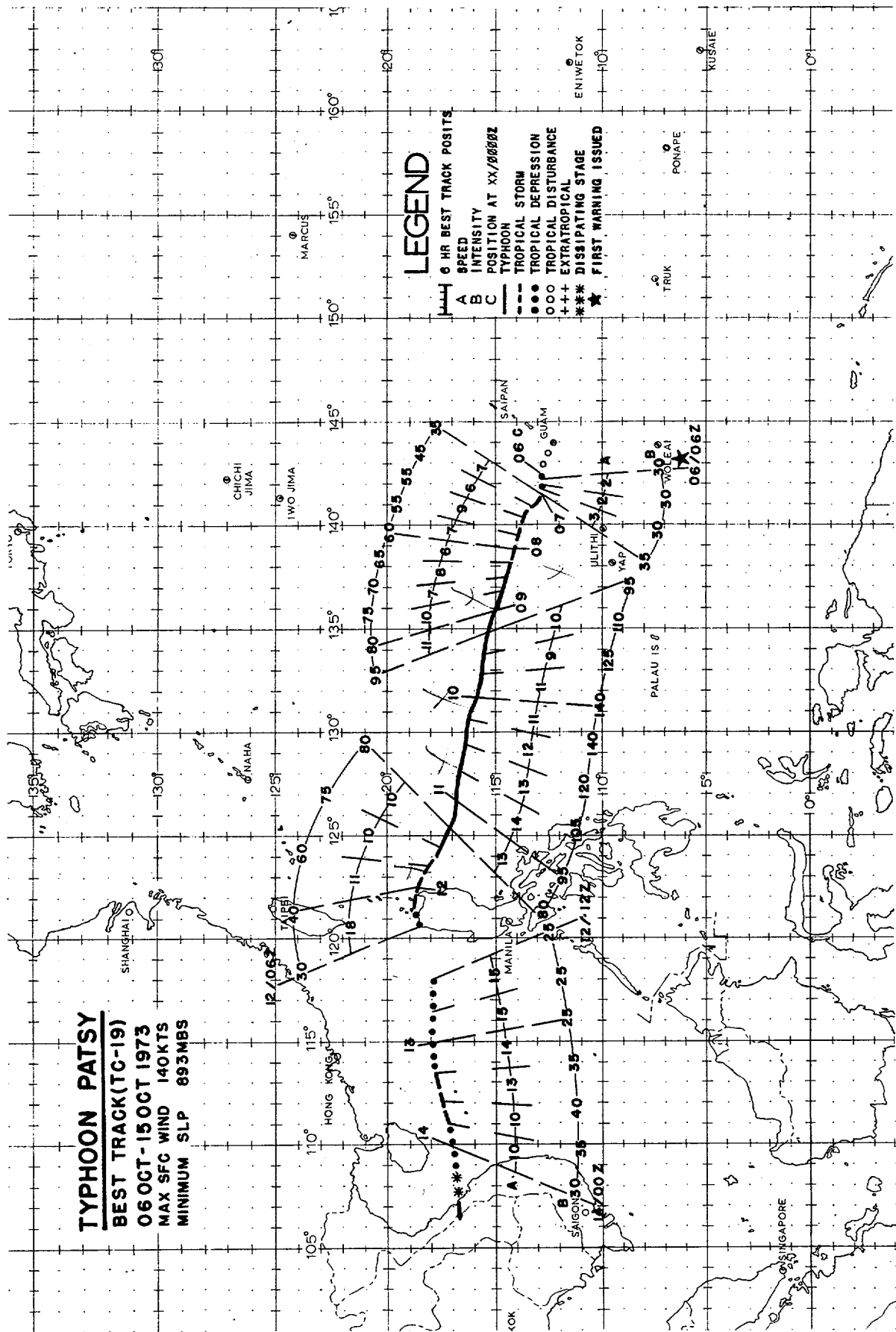
TYPHOON PATSY

BEST TRACK(TC-19)

06 OCT-15 OCT 1973

MAX SFC WIND 140KTS

MINIMUM SLP 893MBS



A weak disturbance formed in the monsoon trough 300nm south of Guam on the 3rd of October. The weak vortex drifted westward in the wake of Nora. Until the 6th, it underwent only minor development due to the strong vertical shear caused by Nora's vigorous upper tropospheric outflow. Reconnaissance aircraft, investigating the disturbance on that day, reported maximum surface winds of 35 kts, heralding the arrival of Tropical Storm Patsy.

For the next two days she followed a westnorthwest course at 6-8 kts under the influence of the steering flow of the mid-tropospheric ridge to the north. Patsy was characteristically a small storm throughout her life. By the 8th she had developed typhoon force winds as she began to accelerate to a speed of 10-12 kts.

A reconnaissance aircraft reported that Patsy had rapidly intensified into a super typhoon with estimated maximum surface winds of 150 kts and a central pressure of 893mb (10/0020 GMT). Her central pressure had dropped 57mb in a span of 22 hours (Figure 4-21).

Patsy continued unerringly toward the northern tip of Luzon as she began to weaken late on the 10th. Interestingly, on

the evening of the 11th, DMSP satellite imagery revealed that Patsy's low level circulation had separated from the upper level portion of the cyclone (Figure 4-22). The low level portion took a more northwesterly course and weakened to a tropical disturbance as it crossed the southern Luzon Strait. Meanwhile, a radar site in the Republic of the Philippines continued to follow the upper level cloudiness as it tracked due west towards Luzon. A similar situation occurred with Susan in 1972.

The upper level circulation drifted over Luzon and out into the South China Sea. It apparently became superimposed over a low level vortex that had been situated in the South China Sea for several days. This system developed to tropical storm intensity as it passed to the north of the Paracel Islands. It weakened to a tropical depression just prior to making landfall in the Republic of Vietnam.

Patsy was the 3rd and final super typhoon of the year. She was only the 2nd storm to form in the western Caroline Islands area in the 1973 season.

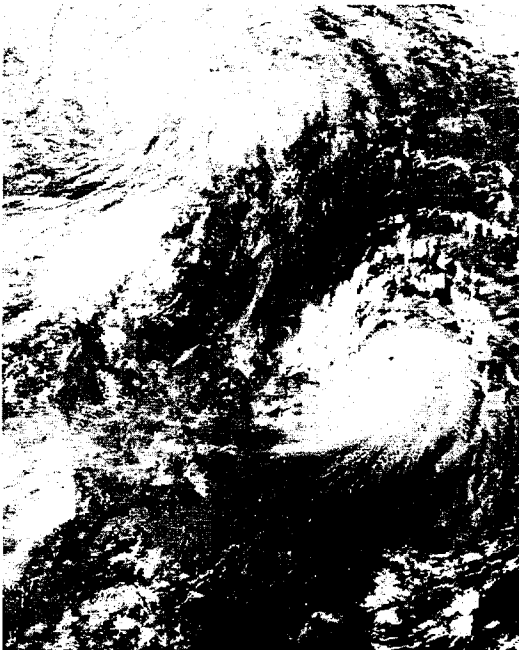


FIGURE 4-21. Super Typhoon Patsy (right) at peak intensity. Typhoon Nora (left) in the Taiwan Strait, 9 October 1973, 2341 GMT. (DMSP imagery)

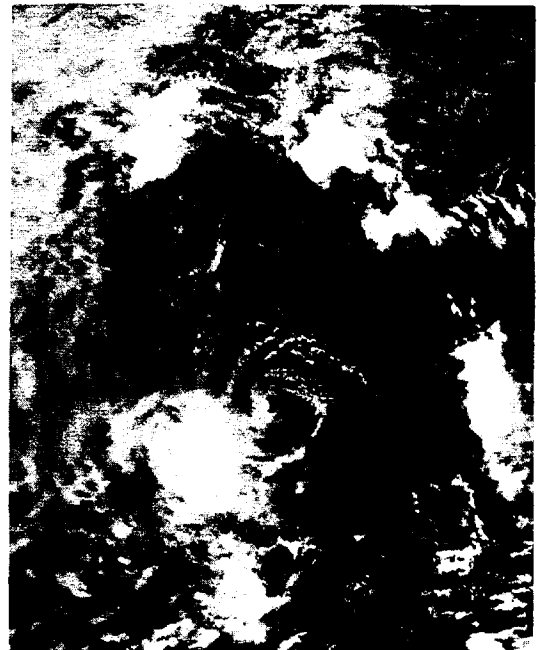


FIGURE 4-22. Moonlight visual of Tropical Storm Patsy. Spiral cumulus pattern depicts the low level circulation with the cirrus canopy displaced to the southwest, 11 October 1973, 1613 GMT. (DMSP imagery)

TYPHOON RUTH

BEST TRACK(TC-20)

11 OCT-19 OCT 1973

MAX SFC WIND 90KTS

MINIMUM SLP 957MBS

LEGEND

6 HR BEST TRACK POSITS:5°

A SPEED

B INTENSITY

C POSITION AT XX/0000Z

--- TYPHOON

--- TROPICAL STORM

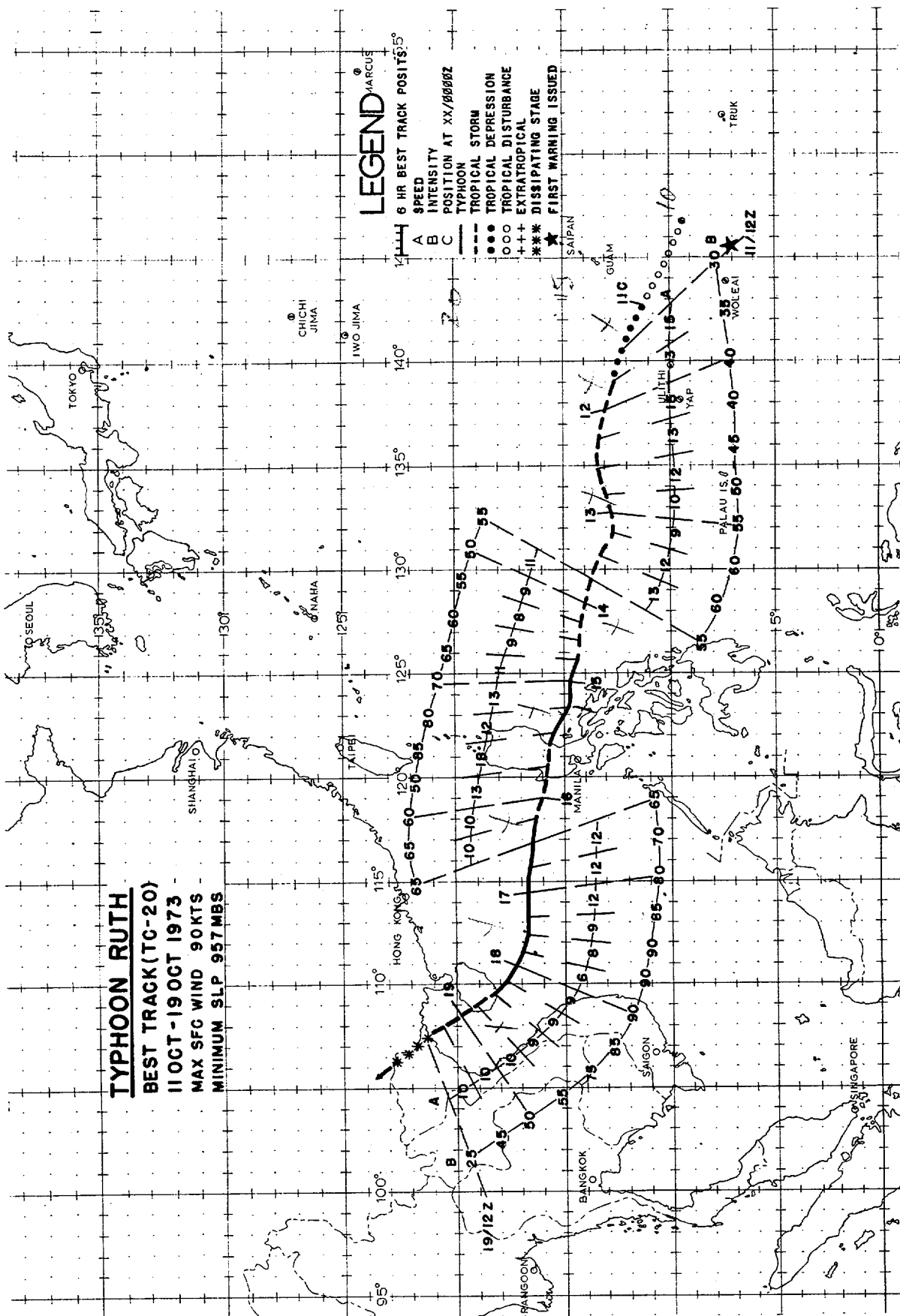
--- TROPICAL DEPRESSION

--- TROPICAL DISTURBANCE

--- EXTRATROPICAL

--- DISSIPATING STAGE

--- FIRST WARNING ISSUED



The formative stage of Ruth appeared early on 10 October as a weak circulation in the monsoon trough in the western Caroline Islands. By the 11th, an area of enhanced convective activity associated with the cyclonic circulation became evident from satellite imagery. Ship reports on the afternoon of the 11th located Tropical Storm Ruth about 250nm westsouthwest of Guam with maximum winds of 35 kts.

Ruth followed 3 days behind Patsy. She tracked approximately 120nm to the south of but parallel to Patsy's track across the Philippine Sea. It is interesting to note that although Patsy intensified rapidly to super typhoon strength, Ruth developed slowly and reached typhoon intensity three days after she became a tropical storm. (Figure 4-23). The satellite data for this period showed little or no convective activity on the north side of Ruth. The strong upper tropospheric northeast flow from the subtropical ridge may have contributed to suppressing the outflow from Ruth on the north side and thereby inhibiting her development.

She continued her westerly movement with slow intensification until landfall on Luzon on the 15th, with maximum sustained wind speeds of 85 kts. Rapid weakening then occurred as the low level inflow was disrupted by terrain effects. Her maximum sustained wind had decreased to 50 kts by the time she reached central Luzon.

Ruth passed 42 miles north of Clark AB late on the night of the 15th where

maximum sustained winds of 30 kts and peak gusts of 43 kts were recorded. Only minor damage was reported at Clark AB. Baler recorded maximum peak gust of 95 kts from the north (15/1355 GMT) while Casiguran 50 nm further north on the coast experienced a gust to 98 kts three hours later (15/1700 GMT).

On the 16th Ruth entered the South China Sea and tracked westward toward the Paracel Islands, still under the steering influence of the subtropical ridge (Figure 4-24). A Japanese ship IDEMITSU MARU reported 50 kts of wind and a surface pressure of 995mb as she passed 90nm northwest of Ruth (16/0000 GMT). She reintensified on her sojourn across the South China Sea reaching a maximum intensity of 90 kts on the afternoon of the 17th just east of the Paracels. Shortly after attaining her maximum intensity, Ruth turned to a northwesterly course in response to a weakness in the subtropical ridge. She then crossed Hainan Island and entered the Tonkin Gulf with maximum sustained winds of 50 kts. Ruth continued to weaken rapidly as upper tropospheric support waned, and dissipated completely as she moved inland along the North Vietnam coast on the afternoon of the 19th.

Damage reports indicate that while Ruth was crossing Luzon, 27 people were killed, 30 people were injured and 23 people were missing. Property damage amounted to more than five million dollars (U.S.) with thousands of homes destroyed.

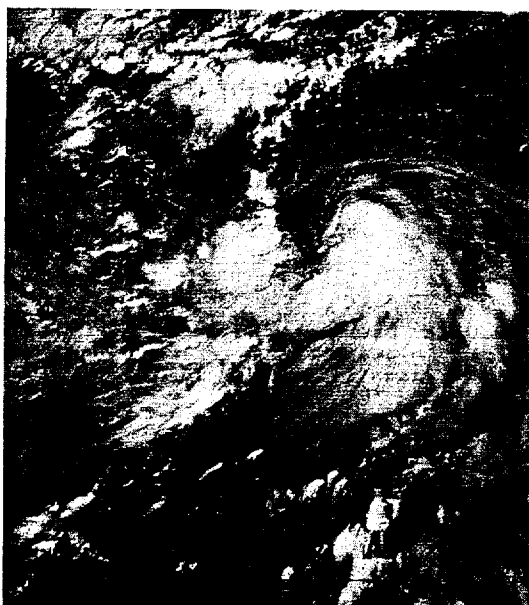


FIGURE 4-23. Tropical Storm Ruth in the Philippine Sea 225 nm east of Catanduanes Island, 14 October 1973, 0009 GMT. (DMSP imagery)

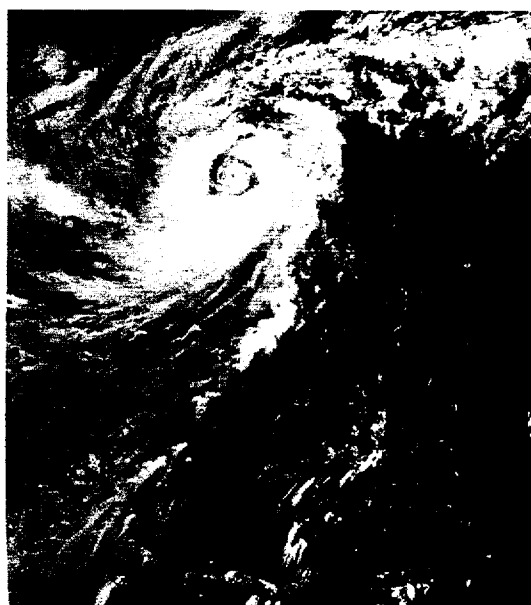


FIGURE 4-24. Tropical Storm Ruth reintensifying after crossing Luzon, 16 October 1973, 0359 GMT. (DMSP imagery)

3. TROPICAL CYCLONE CENTER FIX DATA

a. DISCUSSION OF DATA:

Fix data from all sources are included for each tropical cyclone. The first four columns of the print-out list the same information regardless of platform.

FIX NO.- Fixes are numbered sequentially.
TIME - GMT time in day, hour, and minutes of fix.
POSIT - Position of the storm in degrees and tenths.
FIX CAT- Fix platform used (SAT - satellite, P - penetration, LRDR - land radar, AC R - aircraft radar, SRDR - ship radar, CPA - station experiencing center passage, SCF - synoptic chart fix).

The format of the remainder of the print-out varies with the platform.

(1) SATELLITE - These data were derived from bulletins received from FLEWEAFAC and NESS Suitland, Maryland (NOAA-2), the APT site at U-Tapao, Thailand (ESSA-8), or DMSP (formerly DAPP) data from various sites (Chapter II). Intensity estimates (when available) are listed using the NESS classification system (NOAA Technical Memorandum NESS 45). If the source were DMSP (DAPP) data, the PCN (Position Code Number) appears followed by the name DMSP. If the platform were NOAA-2 or ESSA-8, that name will appear after the intensity information along with the site name and location confidence number (NOAA-2 only), (NHOP, 1973). NOAA-2 fixes without a site name will be assumed to be FLEWEAFAC Suitland fixes.

(2) RADAR - The latitude and longitude of land-based radars are given in the POSIT OF RADAR column. The position of mobile radar platforms are included if available. Plain language remarks appear after AC&W radar reports regarding tropical cyclone characteristics, size, and accuracy of fix (CINCPACINST 3140.11, 1973). All other land radar reports contain a 5-digit code group identical to the WMO radar code for reporting tropical cyclone characteristics as regards to size, development, and accuracy of location of the center or the eye. A list of land-based radars providing data in the fix print-out is given in Table 4-7.

(3) CPA - If a station experiences center passage, maximum surface wind observed and minimum sea level pressure recorded are listed.

(4) SCF - If synoptic data is dense and consistent enough to provide accurate fix information, the derived storm position is listed. Maximum surface wind and minimum sea level pressure values are included, if possible.

(5) AIRCRAFT PENETRATION - These data were normally obtained at scheduled fix times. Additional reconnaissance aircraft fixes are made during the peripheral

data gathering legs between scheduled fixes. These fixes normally provide date, time, and position data only.

The categories containing information from reconnaissance aircraft fixes are:

(a) ACCRY (Accuracy)

The estimated navigation (first number) and meteorological (second number) accuracies are expressed in nautical miles.

(b) FIX LVL (Fix Level)

A constant-pressure-surface flight level (listed in millibars) is normally maintained during a tropical cyclone fix mission. Low-level missions (1500 feet) are conducted at a constant, true altitude.

(c) MAX OBS FLT LVL WND

Wind speed (kt) at flight level is measured by the AN/APN-82 doppler radar system aboard the WC-130 aircraft. The values entered in this category represent the maximum wind measured prior to obtaining a scheduled fix. This measurement may not represent the maximum wind because the aircraft samples only those portions of the central core region along the flight path. For this reason, the maximum observed may be significantly lower than the true maximum wind in the circulation (i.e., penetration through weak semicircle on first fix).

A limitation of the doppler radar system occasionally prevents the measurement of the maximum wind in intense typhoons. In areas of heavy rainfall, the radar may track energy reflected from precipitation rather than the sea surface, preventing accurate wind measurement. Also, the doppler radar mount on the WC-130 restricts wind measurements to drift angles $<27^\circ$ if wind is normal to heading of aircraft.

(d) MAX OBS SFC WND

The maximum surface wind (kt) observed from flight level is entered in this column. The observation is an estimate based on the state of the sea (refer to 9WRWGM 105-1, Vol II, pp 2-27-28). The sampling limitation noted in paragraph (c) also exists for this category. In addition, availability of these data is dependent on the absence of undercast conditions. The position relative to the vortex center of items (c) and (d) need not coincide.

(e) OBS MIN SLP

The minimum observed sea level pressure is normally obtained from a dropsonde released in the vortex center. If the ocean surface is visible, the dropsonde will be released over the center of the area of calm seas; otherwise it is released at the flight level wind center. If the fix is made at 1500 feet, the sea level pressure is extrapolated from that level.

(f) MIN 700 MB HT

The minimum height of the 700mb surface in the vortex center is recorded in decameters.

(g) FLT LVL T_i/T_o

This denotes maximum temperature measured in the center (T_i) and ambient temperature outside the center (T_o). Ambient temperature is measured just prior to entering the wall cloud. Both temperature observations are in degrees celsius and are made at a flight level of constant pressure surface (700, 500-mb).

Reconnaissance aircraft seldom penetrate on the same azimuth from one fix to another. Thus, the position of T_o normally varies from the center, both in bearing and range. The distance is directly dependent on radar definition of the storm.

(h) EYE FORM/ORIENTATION/DIA

The shape and diameter (nautical miles) of the eye are determined by radar. This is reported only if the center is 50% or more surrounded by wall cloud (see definition in Appendix). The orientation of the major axis is for elliptical cases. Abbreviations for the eye form are:

CIRC - Circular
ELIP - Elliptical
CONC - Concentric

REFERENCES:

- Brand, S., "Interaction of Binary Tropical Cyclones of the Western North Pacific Ocean," NAVWEARSCHFAC Tech. Paper No. 26-68, September 1968.
- CINCPACINST 3140.1L, "Tropical Cyclone Operations Manual," June 1973.
- FLEWEACEN/JTWC, Annual Typhoon Report, Guam, Marianas Islands, 1970.
- Ramage, C.S., Monsoon Meteorology, Academic Press, New York and London, 1971, pp. 189-190.
- Sadler, J.C., "The Role of the Upper Tropospheric Trough (TUTT) in Early Season Development," ENVPREDRSCHFAC Tech. Paper, 1973 (in press).
- U.S. Dept. of Commerce, NOAA, Federal Coordinator for Meteorological Services and Supporting Research, "National Hurricane Operations Plan," May 1973.

TABLE 4-7. LAND RADAR SITES

<u>Location</u>	<u>Station No.</u>	<u>ICAO</u>	<u>Station Name</u>
10.3N 124.0E	98646	RPMT	Mactan
	98440		
14.4N 120.6E	98425		Manila
16.4N 120.6E	98328		Baguio
17.4N 104.7E	48357	VTUW	Nakhon Phanom West (USAF)
26.1N 127.8E	47937		Itokau
26.4N 127.8E		RODN	Kadena AB (USAF)
26.2N 127.7E		ROAHJ	Naha AB (JASDF)
24.3N 124.2E	47918		Ishigakijima
28.4N 129.5E	47909		Naze
33.3N 134.2E	47899		Murotomisaki
30.6N 131.0E	47869		Tanegashima/Naka
33.6N 130.5E		RJFFJ	Itazuke Airport (JASDF)
33.4N 130.4E	47806		Fukuoka/Sefurisan
35.9N 126.6E	47141	RKJK	Kunsan AB (USAF)
37.5N 127.0E	47116		Kwanaksan Myn
34.6N 135.7E	47773		Osaka/Takayasuyama
24.3N 120.6E	46770	RCMQ	CCK AB/Taiwan
22.6N 120.3E	46744		Kaohsiung
23.0N 120.2E		RCNN	Tainan (AC&W)
22.6N 120.4E		RCKH	Kaohsiung Int'l Airport (AC&W)
23.5N 119.6E		RCQC	Makung (AC&W)
24.0N 121.6E	46699		Hwalien
22.3N 114.2E	45005		Hong Kong Obsr.
18.1N 120.5E			Paredes (AC&W)
16.6N 120.3E			Wallace AS (AC&W)
14.4N 122.6E			Paranal AS (AC&W)

b. FIX DATA PRINTOUT:

TROPICAL STORM WILUA																				
FIX POSITIONS FOR CYCLONE NO. 1																				
01 JUL 10 03 JUL																				
FIX NO.	TIME	POSIT	FIA CAT	ACQNT	FIA LVL	FLI DIR	LVL VEL	MINU DHG	MINU MRG	SFC MINU	VEL DHG	MINU MRG	OBS SLP	MIN TPO	FLT L1/TU	EYE FORM	OJEN- ACTION	EYE DIA	FUSIT OF NAUAP	MSA NDRN
1	200124Z	11.0N 124.5E	SAI			(11.5/1.5 /		/24MRS)		NUAA 2	(INSS)	(CONF 02)								
2	200124Z	11.0N 124.5E	SAI			(11.5/1.5 /00.5/23MRS)				NUAA 2		(CONF 01)								
3	200124Z	15.0N 125.0E	SAI			(11.5/1.5 /S		/23MRS)		NUAA 2		(CONF 02)								
4	200124Z	15.2N 124.5E	SAI			(11.5/1.5 /		/MRS)		PCN 5	UMSP									
5	200124Z	16.4N 124.2E	SAI			(11.5/1.5 /D		/MRS)		PCN 5	UMSP									
6	200124Z	15.3N 122.4E	SAI							PCN 5	UMSP									
7	200124Z	15.8N 123.7E	SAI							PCN 5	UMSP									
8	200124Z	15.3N 123.5E	SAI							PCN 5	UMSP									
9	300117Z	17.3N 121.8E	SAI			(12.0/2.0 /00.5/25MRS)				NUAA 2	(INSS)	(CONF 01)								
10	300118Z	17.3N 121.5E	SAI			(12.0/2.0 /00.5/25MRS)				NUAA 2	UMSP	(CONF 02)								
11	300440Z	17.3N 121.5E	SAI			(12.0/1.5 /		/MRS)		PCN 3	UMSP									
12	300447Z	17.3N 121.2E	SAI			(11.0/1.5 /00.5/25MRS)				PCN 5	UMSP									
13	300447Z	17.3N 121.2E	SAI			(12.0/2.0 /S		/MRS)		PCN 5	UMSP									
14	301540Z	17.3N 119.0E	SAI							PCN 5	UMSP									
15	301540Z	16.3N 120.4E	SAI							PCN 5	UMSP									
16	010125Z	18.0N 117.5E	SAI	5	25	(12.5/2.0 /00.5/25MRS)				NUAA 2		(CONF 02)								2
17	010125Z	18.0N 117.5E	SAI			(12.5/2.0 /S		/25MRS)		PCN 5	UMSP									
18	010332Z	18.0N 118.0E	SAI			(11.5/1.5 /S		/24MRS)		PCN 5	UMSP									
19	010332Z	18.0N 118.0E	SAI			(11.5/1.5 /S		/24MRS)		PCN 5	UMSP									
20	010708Z	19.0N 118.0E	P	1	4		300	55	430	40	90	35	991	305			CLIC			3
21	011503Z	20.0N 118.0E	P	2	2		130	55	430	100	90	35	991	300						3
22	011710Z	20.0N 118.0E	SAI							PCN 5	UMSP									
23	011710Z	20.0N 118.0E	SAI							PCN 5	UMSP									
24	020133Z	21.2N 117.4E	SAI	5	720	(13.5/3.5 /01.0/23MRS)				NUAA 2	240	20	(CONF 01)	295	10	10				4
25	020133Z	21.2N 117.4E	SAI			(14.0/4.0 /D		/24MRS)		ESSA 5	(VIBU)									
26	020600Z	21.2N 117.4E	P	5	700		220	55	90	25	30	45	985	295	10	10				4
27	020600Z	21.2N 117.4E	SAI			(13.5/3.5 /01.5/24MRS)				PCN 3	UMSP									
28	020600Z	21.2N 117.4E	SAI			(13.5/3.5 /01.5/24MRS)				PCN 3	UMSP									
29	020600Z	21.2N 117.4E	SAI			(13.5/3.5 /01.5/24MRS)				PCN 3	UMSP									
30	020600Z	21.2N 117.4E	SAI			(13.5/3.5 /01.5/24MRS)				PCN 3	UMSP									
31	020600Z	21.2N 117.4E	SAI			(13.5/3.5 /01.5/24MRS)				PCN 3	UMSP									
32	020600Z	21.2N 117.4E	SAI			(13.5/3.5 /01.5/24MRS)				PCN 3	UMSP									
33	020900Z	21.0N 117.9E	LMUR															22.3N 114.2E		
34	020926Z	21.0N 117.8E	AC H															20.9N 117.0E		
35	021200Z	22.0N 117.7E	LMUR															21.4N 116.2E		
36	021500Z	22.0N 117.7E	LMUR															22.3N 114.2E		
37	021500Z	22.0N 117.7E	LMUR															21.9N 116.5E		
38	021701Z	22.0N 117.7E	SAI							PCN 1	UMSP									
39	021701Z	22.0N 117.7E	SAI							PCN 1	UMSP									
40	021701Z	22.0N 117.7E	SAI							PCN 2	UMSP									
41	021701Z	22.0N 117.7E	SAI							PCN 1	UMSP									
42	020200Z	22.0N 117.8E	LMUR															22.3N 114.2E		
43	022100Z	23.0N 118.0E	LMUR															22.3N 114.2E		
44	030000Z	23.0N 117.7E	LMUR															22.3N 116.0E		
45	030114Z	23.0N 117.7E	LMUR															24.3N 120.6E		
46	030400Z	23.0N 118.0E	LMUR																	
47	030200Z	23.0N 117.5E	SAI			(14.0/4.0 /00.5/25MRS)				NUAA 2		(CONF 01)								
48	030300Z	24.0N 119.8E	LMUR															24.3N 120.6E		
49	030300Z	24.0N 119.8E	LMUR															24.3N 120.6E		
50	030400Z	24.0N 118.3E	LMUR															24.3N 120.6E		
51	030400Z	24.0N 118.0E	LMUR															24.3N 120.6E		
52	030600Z	24.2N 118.0E	SAI			(13.5/3.5 /M		/MRS)		PCN 1	UMSP									
53	030600Z	24.0N 118.0E	SAI			(15.0/5.0 /02.0/24MRS)				PCN 1	UMSP							24.3N 120.6E		
54	030400Z	24.0N 118.0E	LMUR															24.3N 120.6E		
55	030400Z	24.0N 118.0E	LMUR															24.3N 120.6E		
56	030500Z	24.0N 117.8E	LMUR															24.3N 120.6E		
57	030500Z	24.0N 118.3E	LMUR															24.3N 120.6E		
58	030500Z	24.0N 118.3E	LMUR															24.3N 120.6E		
59	030600Z	24.0N 118.3E	LMUR															24.3N 120.6E		
60	030700Z	24.0N 118.3E	LMUR															24.3N 120.6E		
61	030600Z	24.0N 118.3E	LMUR															24.3N 120.6E		
62	030600Z	24.0N 118.3E	LMUR															24.3N 120.6E		
63	030600Z	24.0N 118.3E	LMUR															24.3N 120.6E		
64	030800Z	25.0N 118.0E	LMUR															24.3N 120.6E		
65	030800Z	25.0N 118.0E	LMUR															24.3N 120.6E		
66	030700Z	25.0N 118.0E	SAI															24.3N 120.6E		
67	030700Z	25.0N 118.0E	SAI															24.3N 120.6E		
68	030700Z	25.0N 118.0E	SAI															24.3N 120.6E		
69	030700Z	25.0N 118.0E	SAI															24.3N 120.6E		
70	030700Z	25.0N 118.0E	SAI															24.3N 120.6E		
71	031200Z	26.0N 118.0E	SAI															24.3N 120.6E		

TYPHOON ANITA																
FIX POSITION FOR CYCLONE NO. 2																
12 JUL 10 08 JUL																
FIX NO.	TIME	POSIT	FLA	ACCKY	FLA	FLI	MAX UBS	MAX UBS	UWS	MIN	FLT	ETE	DIEN-	ETE	FOU11	
			CAF	NAV-MET	LV1	DIR	VEL	BRG	HNG	VEL	BRG	HNG	SLP	HGT	T1/TU	
															FUMH	
															ATION	
															U1A	
															RAUHP	
															MSA	
															NMEM	
1	050207Z	10.3N 111.0E	SAI				(11.5/1.5 / 00.5/250KTS)			NUAA			(OCNF 03)			
2	050617Z	12.0N 111.0E	SAI				(11.5/1.5 / 00.5/250KTS)			NUAA			(OCNF 03)			
3	050516Z	12.2N 113.0E	SAI				(11.0/1.0 / 5 / 250KTS)			PCN	5	UMSP				
4	060103Z	11.3N 112.5E	SAI				(12.0/2.0 / 00.5/250KTS)			NUAA			(OCNF 03)			
5	060107Z	11.3N 112.5E	SAI				(12.0/2.0 / 00.5/250KTS)			NUAA			(OCNF 03)			
6	060230Z	12.3N 112.0E	P			4	15	700	200	40	120			20	55	140
7	060500Z	12.3N 111.2E	SAI				(12.5/2.5 / 0 / 0KTS)			PCN	3	UMSP		30	996	305
8	060301Z	11.8N 111.2E	SAI				(12.5/2.5 / 01.5/250KTS)			PCN	3	UMSP				
9	060915Z	12.3N 112.5E	P			3	10	700	170	50	70			80	50	70
10	061715Z	13.3N 111.7E	P			5	15	700	180	60	40			20	4	UMSP
11	061740Z	13.2N 111.7E	SAI													
12	062330Z	14.0N 111.4E	P			5	10	700	180	60	50			30	UMSP	
13	070157Z	15.3N 110.2E	SAI				(13.0/3.0 / 01.0/250KTS)			NUAA			(OCNF 02)			
14	070201Z	15.3N 110.2E	SAI				(13.0/3.0 / 01.0/250KTS)			NUAA			(OCNF 01)			
15	070255Z	15.3N 110.4E	SAI				(13.0/4.0 / 0 / 250KTS)			ESSA	8	(V18U)				
16	070330Z	15.4N 110.3E	P			10	20	700	230	50	140			40	80	130
17	070444Z	14.3N 110.0E	SAI				(12.5/2.5 / 5 / 250KTS)			PCN	5	UMSP		30	984	295
18	070845Z	15.7N 110.2E	SAI			5	(13.5/3.5 / 5 / 0KTS)			PCN	3	UMSP		40	80	210
19	070845Z	15.7N 110.2E	SAI							PCN	4	UMSP				
20	071130Z	17.4N 108.7E	SAI							PCN	3	UMSP				
21	071130Z	17.3N 108.8E	SAI							PCN	3	UMSP				
22	072330Z	17.4N 107.7E	SHUM				(14.0/4.0 / 01.0/250KTS)			NUAA			(OCNF 01)			
23	080255Z	18.0N 106.0E	SAI				(14.0/4.0 / 5 / 250KTS)			ESSA	8	(V18U)				
24	080331Z	19.0N 107.2E	SAI				(13.5/3.5 / 01.0/250KTS)			PCN	1	UMSP				
25	080425Z	18.2N 106.5E	SAI				(13.5/3.5 / 01.0/250KTS)			PCN	1	UMSP				
26	080546Z	18.1N 105.5E	SAI				(13.5/3.5 / 01.0/250KTS)			PCN	1	UMSP		30	900	292
27	081010Z	18.3N 105.5E	P			1	(13.5/3.5 / 01.0/250KTS)			PCN	1	UMSP				
28	081644Z	18.8N 105.0E	LKUN				- POSSIBLE EYE 15 DEG									
29	081335Z	18.8N 105.5E	LKUN				- POSSIBLE EYE 15 DEG									
30	081433Z	18.8N 105.2E	LKUN				- CIRCULAR EYE 15 DEG									
31	081335Z	18.9N 105.0E	LKUN				- CIRCULAR EYE 15 DEG									
32	081830Z	19.0N 104.7E	LKUN				- CIRCULAR EYE 15 DEG									
33	081710Z	19.0N 104.1E	SAI							PCN	3	UMSP				
34	081740Z	19.0N 104.5E	LKUN				- CIRCULAR EYE 15 DEG									
35	081810Z	19.1N 104.2E	LKUN				- CIRCULAR EYE 15 DEG									
36	081833Z	19.1N 104.1E	LKUN				- CIRCULAR EYE 15 DEG									
37	081910Z	19.1N 103.9E	LKUN				- CIRCULAR EYE 15 DEG									
38	082010Z	18.9N 103.7E	LKUN				- NO FULL DEFINED EYE, POSSIBLE									
39	080100Z	17.4N 107.2E	CPA				EVF PARACARF-HCS NGDN (100-6)			40				682		
40	080230Z	17.4N 107.2E	CPA							47				684		

TROPICAL STORM CLARA																
FIX POSITION FOR CYCLONE NO. 3																
12 JUL 10 14 JUL																
FIX NO.	TIME	POSIT	FLA	ACCKY	FLA	FLI	MAX UBS	MAX UBS	UWS	MIN	FLT	ETE	DIEN-	ETE	FOU11	MSA
			CAF	NAV-MET	LV1	DIR	VEL	BRG	HNG	SLP	HGT	T1/TU	FUMH	ATION	U1A	RAUHP
1	120136Z	27.0N 165.7E	SAI				(11.0/2.0 / / 0KTS)			PCN	6	UMSP				
2	120136Z	26.0N 163.7E	SAI				(12.0/2.0 / / 0KTS)			PCN	3	UMSP				
3	120136Z	25.0N 164.1E	SAI				(11.5/1.5 / / 0KTS)			PCN	5	UMSP				
4	121439Z	27.0N 162.3E	SAI							PCN	4	UMSP				
5	121439Z	26.9N 162.1E	SAI							PCN	4	UMSP				
6	122130Z	29.2N 161.0E	SAI				(12.5/2.5 / 01.5/250KTS)			NUAA						
7	122131Z	29.2N 161.0E	SAI				(13.0/3.0 / 01.5/250KTS)			NUAA						
8	130131Z	29.5N 160.5E	SAI				(12.0/2.0 / 02.0/250KTS)			PCN	6	UMSP				
9	130131Z	29.5N 160.5E	SAI				(12.0/2.0 / 02.0/250KTS)			PCN	4	UMSP				
10	130131Z	28.8N 160.2E	SAI				(13.0/3.0 / 0 / 0KTS)			PCN	3	UMSP				
11	130455Z	29.0N 160.4E	P			5	10	350	40	270				35	45	200
12	131421Z	29.0N 160.2E	SAI							PCN	4	UMSP				
13	131421Z	30.0N 160.4E	SAI							PCN	4	UMSP				
14	132646Z	31.3N 160.0E	SAI			15	15	700								
15	132629Z	31.3N 159.0E	P							NUAA						
16	140125Z	31.0N 160.0E	SAI				(12.0/3.0 / 01.0/250KTS)			PCN	6	UMSP				
17	140125Z	31.0N 162.0E	SAI				(12.5/3.0 / 00.5/250KTS)			PCN	6	UMSP				
18	140126Z	31.3N 161.7E	SAI				(12.5/3.0 / 02.0/250KTS)			PCN	3	UMSP				
19	141600Z	32.0N 163.1E	SAI							PCN	5	UMSP				

13 JUL 10 19 JUL
MAY 1985 MAY 1985

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FIX POSITIONS FOR CYCLONE NO. 4

FIA NO.	TIME	POSIT	LAT	ACCHY NAV-MET	FLX LVL	13 JUL 10 19 JUL				MAX OBS		OBS MIN SLP	700MB HGT	FLY LVL 11/10	EYE FORM	RFLN-ATION	EYE DIA	-POSTI OF: RADAR	MSA MPM
						FLX LVL	WIND BNG	RNG	SFC WIND VEL	WIND BNG	RNG								
101	101300Z	25.7N 125.7E	LRUK		- 10413													24.3N 124.3E	
102	101700Z	25.7N 125.7E	LRUK		-										-	-	-	26.1N 121.8E	
103	101700Z	26.0N 125.7E	LRUK		- 10417													24.3N 124.2E	
104	101300Z	26.2N 125.0E	LRUK		- 11413													26.1N 121.8E	
105	101600Z	26.3N 125.5E	LRUK		- 21447													26.1N 121.8E	
106	101800Z	26.4N 125.0E	P	3	1	700	220	11V	120	15	-	-	-	929	249	2J	11	CIRC	12
107	101800Z	26.3N 125.5E	LRUK		- 13443													24.3N 124.2E	
108	101700Z	26.5N 125.5E	LRUK		- 25747													24.3N 124.2E	
109	101701Z	26.4N 125.7E	SAI																
110	101701Z	26.4N 125.7E	SAI																
111	101701Z	26.4N 125.7E	SAI																
112	101800Z	26.7N 125.5E	LRUK		- 25743													24.3N 124.2E	
113	101800Z	26.0N 125.4E	LRUK		- 15637													26.1N 127.8E	
114	101900Z	26.4N 125.5E	LRUK		- 25543													26.1N 127.8E	
115	102000Z	27.0N 125.5E	LRUK		- 25723													26.1N 127.8E	
116	102100Z	27.1N 125.1E	LRUK		- 25634													26.1N 127.8E	
117	102200Z	27.2N 125.0E	LRUK		- 37534													26.1N 127.8E	
118	102300Z	27.3N 125.7E	P	4	6	37500	-	-	-	-	130	190	13	944	262	1V	13	CIRC	10
119	102300Z	27.3N 125.7E	LRUK		- 37544													26.1N 127.8E	
120	10131Z	28.0N 124.5E	SAI																
121	10131Z	28.0N 124.5E	SAI																
122	10131Z	28.0N 124.5E	SAI																
123	101402Z	28.0N 125.1E	SAI																
124	101402Z	28.0N 125.1E	SAI																
125	101402Z	28.0N 125.1E	SAI																
126	101402Z	28.0N 125.1E	SAI																
127	101402Z	28.0N 125.1E	SAI																
128	101402Z	28.0N 125.1E	SAI																
129	101402Z	28.0N 125.1E	SAI																
130	101402Z	28.0N 125.1E	SAI																
131	101402Z	28.0N 125.1E	SAI																
132	101402Z	28.0N 125.1E	SAI																
133	101402Z	28.0N 125.1E	SAI																
134	101402Z	28.0N 125.1E	SAI																
135	101402Z	28.0N 125.1E	SAI																
136	101402Z	28.0N 125.1E	SAI																
137	101402Z	28.0N 125.1E	SAI																
138	101402Z	28.0N 125.1E	SAI																
139	101402Z	28.0N 125.1E	SAI																
140	101402Z	28.0N 125.1E	SAI																
141	101402Z	28.0N 125.1E	SAI																
142	101402Z	28.0N 125.1E	SAI																
143	101402Z	28.0N 125.1E	SAI																
144	101402Z	28.0N 125.1E	SAI																
145	101402Z	28.0N 125.1E	SAI																
146	101402Z	28.0N 125.1E	SAI																
147	101402Z	28.0N 125.1E	SAI																
148	101402Z	28.0N 125.1E	SAI																
149	101402Z	28.0N 125.1E	SAI																
150	101402Z	28.0N 125.1E	SAI																
151	101402Z	28.0N 125.1E	SAI																
152	101402Z	28.0N 125.1E	SAI																
153	101402Z	28.0N 125.1E	SAI																
154	101402Z	28.0N 125.1E	SAI																
155	101402Z	28.0N 125.1E	SAI																
156	101402Z	28.0N 125.1E	SAI																
157	101402Z	28.0N 125.1E	SAI																
158	101402Z	28.0N 125.1E	SAI																
159	101402Z	28.0N 125.1E	SAI																
160	101402Z	28.0N 125.1E	SAI																
161	101402Z	28.0N 125.1E	SAI																
162	101402Z	28.0N 125.1E	SAI																
163	101402Z	28.0N 125.1E	SAI																
164	101402Z	28.0N 125.1E	SAI																
165	101402Z	28.0N 125.1E	SAI																
166	101402Z	28.0N 125.1E	SAI																
167	101402Z	28.0N 125.1E	SAI																
168	101402Z	28.0N 125.1E	SAI																
169	101402Z	28.0N 125.1E	SAI																
170	101402Z	28.0N 125.1E	SAI																
171	101402Z	28.0N 125.1E	SAI																
172	101402Z	28.0N 125.1E	SAI																
173	101402Z	28.0N 125.1E	SAI																
174	101402Z	28.0N 125.1E	SAI																
175	101402Z	28.0N 125.1E	SAI																
176	101402Z	28.0N 125.1E	SAI																
177	101402Z	28.0N 125.1E	SAI																
178	101402Z	28.0N 125.1E	SAI																
179	101402Z	28.0N 125.1E	SAI																
180	101402Z	28.0N 125.1E	SAI																
181	101402Z	28.0N 125.1E	SAI																
182	101402Z	28.0N 125.1E	SAI																
183	101402Z	28.0N 125.1E	SAI																
184	101402Z	28.0N 125.1E	SAI																
185	101402Z	28.0N 125.1E	SAI																
186	101402Z	28.0N 125.1E	SAI																
187	101402Z	28.0N 125.1E	SAI																
188	101402Z	28.0N 125.1E	SAI																
189	101402Z	28.0N 125.1E	SAI																
190	101402Z	28.0N 125.1E	SAI																
191	101402Z	28.0N 125.1E	SAI																
192	101402Z	28.0N 125.1E	SAI																
193	101402Z	28.0N 125.1E	SAI																
194	101402Z	28.0N 125.1E	SAI																
195	101402Z	28.0N 125.1E	SAI																
196	101402Z	28.0N 125.1E	SAI																
197	101402Z	28.0N 125.1E	SAI																
198	101402Z	28.0N 125.1E	SAI																
199	101402Z	28.0N 125.1E	SAI																
200	101402Z	28.0N 125.1E	SAI																

TYPHOON DOT
 FIX POSITIONS FOR CYCLONE NO. 5
 14 JUL TO 20 JUL

[illegible]

TYPMON FOR CYCLONE NO. 5

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVL	FLI DIR	LYL VEL	MIN WNG	MAX WBS VEL	WBS WNG	WBS HNG	WBS SLP	MIN SLP	700MB HGT	CLT 11/10	EYE FORM	DIEN- TION	EYE DIA	POSIT OF RADAR	MSA NDB
51	102000Z	22.2N 114.4E	LKUH	-															22.3N 114.4E	
52	102100Z	22.3N 114.4E	LKUH	-															22.3N 114.4E	
53	102300Z	22.6N 114.5E	LKUH	-															22.3N 114.4E	
54	100000Z	22.7N 114.6E	LKUH	-															22.3N 114.4E	
55	101000Z	22.7N 114.6E	LKUH	-															22.3N 114.4E	
56	100000Z	23.0N 114.8E	LKUH	-															22.3N 114.4E	
57	100300Z	23.3N 115.0E	LKUH	-															22.3N 114.4E	
58	100400Z	23.2N 115.4E	SAI																	
59	100400Z	23.4N 114.9E	SAI																	
60	100400Z	25.7N 115.1E	SAI																	
61	101600Z	25.0N 110.4E	SAI																	
62	101600Z	25.0N 110.4E	SAI																	
63	101600Z	27.7N 115.1E	SAI																	
64	101930Z	27.2N 125.0E	SAI																	
65	101200Z	28.0N 126.0E	SAI																	
66	101300Z	28.0N 126.0E	SAI																	
67	101330Z	28.2N 127.1E	SAI																	
68	100330Z	28.3N 126.4E	SAI																	
69	100330Z	28.4N 127.8E	SAI																	
70	100300Z	28.7N 126.8E	SAI																	
71	100300Z	28.0N 126.8E	CHUR																	
72	100510Z	27.8N 126.9E	LKUH																	
73	100500Z	28.3N 127.3E	LKUH																	
74	100500Z	30.7N 127.1E	LKUH																	
75	101500Z	30.7N 127.1E	P 20																	
76	101610Z	31.4N 127.0E	SAI																	
77	101610Z	30.8N 126.3E	SAI																	
78	101600Z	31.3N 127.1E	SAI																	
79	101600Z	31.3N 127.1E	CHUR																	
80	102100Z	31.3N 127.2E	LKUH																	
81	102200Z	32.1N 127.0E	LKUH																	
82	102300Z	32.4N 127.0E	LKUH																	
83	200020Z	33.2N 126.2E	SAI																	
84	200020Z	33.8N 126.3E	SAI																	
85	200310Z	33.8N 126.3E	SAI																	
86	201600Z	37.4N 126.3E	SAI																	
87	102300Z	22.7N 114.7E	CPA																	
88	102000Z	22.8N 114.8E	SCF																	
89	100000Z	22.8N 114.8E	SCF																	

TYPMON ELLEN
FIX POSITIONS FOR CYCLONE NO. 6

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVL	FLI DIR	LYL VEL	MIN WNG	MAX WBS VEL	WBS WNG	WBS HNG	WBS SLP	MIN SLP	700MB HGT	CLT 11/10	EYE FORM	DIEN- TION	EYE DIA	POSIT OF RADAR	MSA NDB
1	102300Z	20.3N 138.0E	SAI																	
2	102300Z	20.0N 138.0E	SAI																	
3	102210Z	20.3N 138.3E	SAI																	
4	102210Z	20.3N 138.3E	SAI																	
5	101300Z	21.0N 139.4E	SAI																	
6	101300Z	21.0N 139.4E	P																	
7	102300Z	22.2N 139.0E	SAI																	
8	100030Z	22.2N 138.2E	SAI																	
9	100030Z	22.2N 138.2E	SAI																	
10	100030Z	22.2N 138.2E	SAI																	
11	100200Z	22.2N 138.2E	SAI																	
12	100200Z	22.2N 138.2E	SAI																	
13	100310Z	22.4N 138.3E	P																	
14	100300Z	22.3N 138.4E	SAI																	
15	100300Z	22.3N 138.2E	SAI																	
16	100300Z	22.7N 138.4E	P																	
17	101400Z	23.0N 137.4E	SAI																	
18	101400Z	23.0N 138.1E	SAI																	
19	101400Z	22.7N 138.0E	SAI																	
20	101400Z	23.1N 138.4E	SAI																	
21	101300Z	23.1N 137.0E	SAI																	
22	101300Z	23.1N 137.0E	SAI																	
23	102300Z	24.0N 138.2E	P																	
24	102300Z	24.0N 138.0E	SAI																	
25	100300Z	24.0N 138.0E	SAI																	
26	100300Z	24.7N 138.2E	AC H																	
27	101510Z	25.1N 138.1E	SAI																	
28	101510Z	24.8N 138.0E	SAI																	
29	100300Z	25.3N 138.2E	SAI																	
30	100300Z	25.2N 138.0E	SAI																	
31	100300Z	25.3N 138.5E	SAI																	
32	100300Z	25.3N 138.3E	SAI																	
33	101300Z	28.5N 138.2E	P																	
34	101300Z	28.5N 138.2E	P																	
35	101610Z	27.0N 138.5E	SAI																	
36	101610Z	27.0N 138.3E	SAI																	
37	101610Z	27.7N 138.5E	SAI																	
38	101610Z	28.0N 138.4E	SAI																	
39	102100Z	28.8N 138.3E	P																	
40	200020Z	29.4N 138.0E	SAI																	
41	200020Z	29.7N 138.0E	SAI																	
42	200310Z	30.2N 138.0E	SAI																	
43	200310Z	30.2N 138.0E	SAI																	
44	200310Z	30.2N 138.0E	SAI																	
45	200310Z	30.2N 138.0E	P																	
46	200310Z	31.1N 137.0E	P																	
47	201600Z	32.1N 138.0E	SAI																	
48	201600Z	32.1N 138.0E	SAI																	
49	201600Z	32.0N 138.5E	P																	
50	202100Z	32.3N 138.5E	P																	

TYPHOON ELLEN FIX POSITIONS FOR CYCLONE NO. 6																		
17 JUL TO 29 JUL MAX OBS																		
FIX NO.	TIME	POSIT	FIA CAT	ACCHY NAV-MET	Fix LVI	FL DIR	WIND VEC	WIND DIR	SFC WIND VEC	SFC WIND DIR	OBS SLP	MIN T	FLT T	WIND T	WIND T	WIND T	WIND T	WIND T
51	210421Z	32.0N 135.0E	SAT		(12.0/3.0 /M1.0/25MRS)													
52	210504Z	32.1N 136.2E	SAT		(12.0/3.0 /M1.5/24MRS)													
53	210504Z	31.9N 136.2E	SAT		(12.0/3.0 /M1.0/24MRS)													
54	210515Z	32.0N 136.5E	P	5	5	-	40	20	310									
55	210502Z	31.9N 136.0E	SAT															
56	210502Z	32.2N 135.0E	SAT		(11.5/2.5 /M1.0/24MRS)													
57	220522Z	31.2N 136.0E	SAT		(12.5/2.5 /M0.5/23MRS)													
58	220504Z	31.4N 136.4E	SAT		(12.0/2.0 /M /24MRS)													
59	220504Z	31.5N 136.3E	SAT		(12.0/2.0 /M /24MRS)													
60	221533Z	30.8N 132.5E	SAT															
61	221533Z	30.8N 132.5E	SAT															
62	230504Z	31.1N 134.9E	P	5	5	-	320	30	220									
63	230510Z	31.1N 131.1E	SAT		(13.0/3.0 /M1.0/24MRS)													
64	230510Z	31.2N 132.0E	SAT		(13.0/3.0 /M0.5/23MRS)													
65	230510Z	31.2N 132.0E	SAT		(13.0/3.0 /M1.0/24MRS)													
66	230530Z	30.7N 132.5E	SAT		(13.5/3.5 /M1.5/24MRS)													
67	230530Z	31.0N 132.3E	SAT		(13.0/3.0 /M1.0/24MRS)													
68	230504Z	30.8N 132.5E	LKUH		- 357/1													
69	230504Z	30.8N 132.5E	LKUH		- 357/1													
70	230504Z	30.9N 132.4E	LKUH		- 357/1													
71	230504Z	30.9N 132.4E	LKUH		- 357/1													
72	230504Z	30.9N 132.3E	LKUH		- 357/1													
73	230504Z	30.9N 132.2E	LKUH		- 357/1													
74	230504Z	30.8N 132.1E	LKUH		- 357/1													
75	230504Z	30.9N 132.0E	LKUH		- 357/1													
76	230504Z	30.8N 131.0E	LKUH		- 357/1													
77	230504Z	30.8N 131.0E	LKUH		- 357/1													
78	230504Z	30.7N 131.0E	LKUH		- 357/1													
79	230504Z	30.7N 131.0E	LKUH		- 357/1													
80	231200Z	30.4N 131.2E	LKUH		- 250/1													
81	231200Z	30.4N 131.2E	LKUH		- 250/1													
82	231200Z	30.1N 130.8E	LKUH		- 357/1													
83	231200Z	30.1N 131.4E	LKUH		- 10101													
84	231200Z	29.8N 130.8E	LKUH		- 357/1													
85	231219Z	30.1N 130.9E	SAT															
86	231219Z	29.9N 130.9E	SAT															
87	231219Z	30.0N 131.5E	SAT															
88	231200Z	30.1N 131.2E	LKUH		- 101/2													
89	231200Z	30.1N 131.0E	LKUH		- 10235													
90	231200Z	30.1N 131.0E	LKUH		- 203/1													
91	231200Z	29.9N 131.2E	SAT															
92	231200Z	29.9N 130.9E	SAT		- 10337													
93	231200Z	30.2N 130.9E	LKUH		- 20321													
94	231200Z	30.2N 130.9E	LKUH		- 20341													
95	231200Z	30.2N 130.9E	LKUH		- 20341													
96	231200Z	30.2N 130.9E	LKUH		- 20312													
97	231200Z	30.2N 130.9E	LKUH		- 20311													
98	231200Z	30.2N 130.9E	LKUH		- 20341													
99	231200Z	30.2N 130.9E	LKUH		- 20312													
100	231200Z	30.2N 130.9E	LKUH		- 20312													
101	231200Z	30.3N 130.9E	LKUH		- 20312													
102	231200Z	30.3N 130.9E	LKUH		- 20421													
103	231200Z	30.3N 130.9E	LKUH		- 20411													
104	231200Z	30.3N 130.9E	LKUH		- 20342													
105	240500Z	30.4N 130.2E	LKUH		- 20301													
106	240500Z	30.4N 130.3E	LKUH		- 20312													
107	240510Z	30.1N 129.0E	SAT		(12.5/3.0 /M0.5/24MRS)													
108	240510Z	30.1N 129.0E	SAT		(12.0/3.0 /M1.0/24MRS)													
109	240500Z	30.3N 130.1E	LKUH		- 05/01													
110	240500Z	30.3N 130.3E	LKUH		- 30345													
111	240500Z	30.3N 130.9E	LKUH		- 20312													
112	240500Z	30.3N 130.9E	LKUH		- 20871													
113	240500Z	29.9N 129.5E	SAT		(13.0/3.0 /M /24MRS)													
114	240500Z	30.1N 130.0E	SAT		(12.0/3.0 /M1.0/24MRS)													
115	240500Z	30.3N 129.5E	SAT		(13.0/3.0 /M0.5/24MRS)													
116	240500Z	30.3N 129.5E	SAT		- 20312													
117	240500Z	30.3N 129.5E	LKUH		- 20312													
118	240500Z	30.3N 129.5E	LKUH		- 20312													
119	240500Z	30.3N 129.5E	LKUH		- 20312													
120	240500Z	30.3N 129.5E	SAT		(13.0/3.0 /M /24MRS)													
121	240500Z	30.3N 129.5E	SAT		(13.5/3.5 /M /24MRS)													
122	240500Z	30.3N 129.5E	SAT		(12.0/3.0 /M1.0/24MRS)													
123	240500Z	30.3N 129.5E	LKUH		- 05/01													
124	240500Z	30.7N 129.7E	LKUH		- 55812													
125	240500Z	30.7N 129.7E	LKUH		- 557/1													
126	240500Z	30.7N 129.7E	LKUH		- 557/1													
127	241000Z	30.7N 129.5E	LKUH		- 10551													
128	241000Z	30.7N 129.5E	LKUH		- 10551													
129	241000Z	30.7N 129.5E	LKUH		- 10551													
130	241000Z	30.7N 129.5E	LKUH		- 10551													
131	241200Z	30.7N 129.5E	LKUH		- 10551													
132	241200Z	30.7N 129.5E	LKUH		- 10551													
133	241300Z	30.7N 129.5E	LKUH		- 11801													
134	241300Z	30.7N 129.5E	LKUH		- 22911													
135	241400Z	30.7N 129.5E	LKUH		- 05/01													
136	241400Z	31.0N 129.6E	LKUH		- 05/01													
137	241500Z	31.1N 129.0E	LKUH		- 20507													
138	241500Z	31.2N 129.4E	LKUH		- 20712													
139	241500Z	31.3N 129.5E	LKUH		- 20712													
140	241500Z	31.4N 129.6E	SAT															
141	241500Z	31.0N 129.3E	SAT															
142	241700Z	31.3N 129.5E	LKUH		- 21932													
143	242000Z	31.0N 129.5E	LKUH		- 21932													
144	242000Z	31.0N 129.5E	LKUH		- 55/16													
145	242100Z	31.3N 129.5E	LKUH		- 21603													
146	242000Z	31.0N 129.5E	LKUH		- 11812													
147	242200Z	31.0N 129.5E	P	- 10	019													
148	242300Z	31.7N 129.5E	LKUH		- 10612													
149	250500Z	31.0N 129.5E	LKUH		- 10612													
150	250500Z	31.0N 129.5E	LKUH		- 10612													

FIX NO.	TIME	POSIT	FIX LAT	ACQY NAV-MET	FIX LVL	MAX OBS				MAX OBS				QWS SLP	MIN HGT	FLT T1/T0	EYE FORM	RIEN- ACTION	EYE DIA	FOOT OF RADAR	MSA Mph
						FLT DIR	LVL VEL	WIND BKG	RNG	SFC VEL	WIND BKG	RNG									
1	242322Z	12.0N 130.0E	SAI	(11.5/1.5	100.5/24MRS					NUAA 2 (NESS)	(CONF 02)										
2	250342Z	11.4N 130.0E	SAI	(11.5/1.5	100.5/24MRS					PCN 5 UMSP											
3	250348Z	11.4N 130.0E	SAI	(12.0/2.0	101.0/23MRS					PCN 5 UMSP											
4	260010Z	11.5N 130.0E	SAI	(11.5/1.5	100.5/23MRS					NUAA 2	(CONF 01)										
5	270335Z	11.3N 130.0E	SAI	(11.5/1.5	100.5/23MRS					PCN 5 UMSP											
6	270335Z	11.3N 130.0E	SAI	(12.0/2.0	100.5/23MRS					NUAA 2	(CONF 01)										
7	270335Z	11.3N 130.0E	SAI	(12.0/2.0	100.5/23MRS					PCN 3 UMSP											
8	270335Z	11.3N 130.0E	SAI	(11.5/1.5	100.5/23MRS					PCN 3 UMSP											
9	271006Z	11.2N 129.1E	SAI	(12.0/2.0	100.5/23MRS					PCN 5 UMSP											
10	280010Z	11.0N 127.5E	SAI	(12.0/2.0	100.5/23MRS					NUAA 2 (NESS)	(CONF 02)										
11	280034Z	11.0N 127.5E	SAI	(12.0/2.0	100.5/23MRS					NUAA 2 UMSP	(CONF 02)										
12	280034Z	11.0N 127.5E	SAI	(11.5/1.5	100.5/23MRS					PCN 5 UMSP											
13	280340Z	11.0N 127.5E	SAI	(11.5/1.5	100.5/23MRS					PCN 5 UMSP											
14	280340Z	11.0N 127.5E	SAI	(11.5/1.5	100.5/23MRS					PCN 5 UMSP											
15	281240Z	10.1N 124.1E	SAI							PCN 5 UMSP											
16	282350Z	10.2N 123.5E	P							PCN 5 UMSP											
17	290100Z	10.1N 124.0E	SAI	5 6	110 30	50				PCN 5 UMSP											4
18	290300Z	10.2N 123.5E	P							PCN 5 UMSP											
19	290300Z	10.2N 123.5E	P							PCN 5 UMSP											4
20	290300Z	10.2N 123.5E	P							PCN 5 UMSP											5
21	290300Z	10.2N 123.5E	P							PCN 5 UMSP											5
22	290300Z	10.2N 123.5E	P							PCN 5 UMSP											5
23	290300Z	10.2N 123.5E	P							PCN 5 UMSP											6
24	290300Z	10.2N 123.5E	P							PCN 5 UMSP											7

FIA NO.	TIME	POSIT	FIA LAT	ACCHY NAV-MET	FIX LVL	FLI DIR	LVL VEL	IND BRG	12 AUG	MAX OBS VEL	OBS CRG	OBS RNG	MIN SLP	MIN 700MB HGT	FLT LVL	EYE FORM	RETEN- TION	EYE DIA	POSIT OF RADAR	MSA MHPH
1	000040Z	20.0N 114.0E	SAI	(12.0/2.0 / 01.0/2.0PHS)						NVAA 2 (NESS)	(CONF 01)									
2	000041Z	20.0N 114.0E	SAI	(12.0/2.0 / 00.5/2.0PHS)						NVAA 2 (NESS)	(CONF 01)									
3	000042Z	21.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						ESSA 2 (V1BU)										
4	000043Z	20.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 5 UMSP										
5	000044Z	20.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 5 UMSP										
6	000045Z	20.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 5 UMSP										
7	000046Z	20.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						NVAA 2 (NESS)										
8	000047Z	20.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						NVAA 2 (NESS)										
9	000048Z	20.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						NVAA 2 (NESS)										
10	000049Z	20.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						ESSA 2 (V1BU)										
11	000050Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
12	000051Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
13	000052Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
14	000053Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
15	000054Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
16	000055Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
17	000056Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
18	000057Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
19	000058Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
20	000059Z	20.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
21	000100Z	20.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
22	000101Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
23	000102Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
24	000103Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
25	000104Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
26	000105Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
27	000106Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
28	000107Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
29	000108Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
30	000109Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
31	000110Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
32	000111Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
33	000112Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
34	000113Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
35	000114Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
36	000115Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
37	000116Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
38	000117Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
39	000118Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
40	000119Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
41	000120Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
42	000121Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
43	000122Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
44	000123Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
45	000124Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
46	000125Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
47	000126Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
48	000127Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
49	000128Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
50	000129Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
51	000130Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
52	000131Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
53	000132Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
54	000133Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
55	000134Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
56	000135Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
57	000136Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
58	000137Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
59	000138Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
60	000139Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
61	000140Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
62	000141Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
63	000142Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
64	000143Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
65	000144Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
66	000145Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
67	000146Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
68	000147Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
69	000148Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										
70	000149Z	19.0N 114.0E	SAI	(11.5/1.5 / 00.5/2.0PHS)						PCN 3 UMSP										

[illegible][illegible]

FAX NO.	TIME	POSIT	FAX CAT	ACCRY NAV-MET	FAX LVL	10 AUG TO 17 AUG				OBS SFC WIND	OBS MIN SLP	MIN 700MB HGT	FLT LVL T1/T0	EYE FORM	ORIENT TATION	DYE	FOSIT OF RADAR	MNR
						FLY VEL	HRG	RNG	VEL BRG									
51	131210Z	23.0N 132.3E	SAT															
52	131215Z	24.0N 132.1E	P	10	10		330	05	240	30								11
53	131217Z	24.0N 132.3E	P	10	10		330	05	310	30								11
54	140002Z	24.0N 132.0E	SAT				(12.0/0.5) 0	/S	(250KTS)	NUAA 2								
55	140020Z	24.0N 132.1E	SAT				(12.0/0.5) 0	/S	(240KTS)	PCN 3	UMSP							
56	140025Z	25.0N 132.3E	SAT				(14.0/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
57	140030Z	25.0N 132.0E	SAT				(16.0/0.5) 0	/M	(1.0/240KTS)	PCN 1	UMSP							
58	140035Z	25.0N 131.0E	SAT				(14.5/0.5) 0	/M	(0.5/240KTS)	PCN 1	UMSP							
59	140040Z	25.0N 132.1E	SAT				(16.0/0.5) 0	/S	(250KTS)	PCN 3	UMSP							
60	140045Z	25.0N 131.0E	SAT				(12.0/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
61	140050Z	25.0N 132.2E	SAT				(12.0/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
62	140055Z	24.0N 132.0E	P				(12.0/0.5) 0	/S	(250KTS)	PCN 3	UMSP							
63	140057Z	25.0N 131.0E	P	2	10	700	240	05	130	100	50	130	120					12
64	140100Z	27.0N 130.0E	P	5	10	700	140	05	60	80								13
65	140102Z	26.0N 131.1E	P							PCN 3	UMSP							
66	140105Z	27.0N 130.0E	SAT							PCN 3	UMSP							
67	140107Z	26.0N 130.0E	SAT							PCN 2	UMSP							
68	140110Z	26.0N 130.0E	SAT							PCN 3	UMSP							
69	140112Z	26.0N 130.0E	SAT							PCN 3	UMSP							
70	140100Z	27.0N 131.3E	LRUH														28.4N 129.0E	
71	140100Z	28.2N 130.0E	LRUH														28.4N 129.0E	
72	140100Z	28.0N 130.0E	LRUH														28.4N 129.0E	
73	140100Z	28.0N 130.0E	LRUH	5	20	700	220	50	130	135	60	130	135					14
74	150002Z	28.0N 129.0E	LRUH				14.0/0.5) 0	/M	(1.0/250KTS)	NUAA 2							33.6N 130.0E	
75	150005Z	28.0N 129.0E	SAT															
76	150007Z	28.0N 129.0E	LRUH														28.4N 129.0E	
77	150010Z	28.0N 129.0E	LRUH														28.4N 129.0E	
78	150012Z	28.0N 129.0E	SAT				(13.5/0.5) 0	/M	(1.0/240KTS)	PCN 1	UMSP							
79	150014Z	28.0N 129.0E	SAT				(14.0/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
80	150016Z	28.0N 129.0E	SAT				(15.0/0.5) 0	/M	(1.0/240KTS)	PCN 1	UMSP							
81	150018Z	28.0N 128.0E	SAT				(13.5/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
82	150020Z	28.0N 129.0E	SAT				(14.0/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
83	150000Z	28.0N 129.0E	LRUH														28.4N 129.0E	
84	150002Z	28.0N 129.0E	LRUH	1	15	700	230	50	160	90	45	150	110					15
85	150004Z	28.0N 129.0E	LRUH														33.6N 130.0E	
86	150006Z	28.0N 129.0E	LRUH														33.6N 130.0E	
87	150008Z	28.0N 128.0E	LRUH														28.4N 129.0E	
88	150010Z	28.0N 128.0E	LRUH	10	15	700	220	30	170	30							28.4N 129.0E	
89	150012Z	28.0N 128.0E	LRUH															16
90	150014Z	28.0N 128.0E	LRUH														33.6N 129.0E	
91	150016Z	28.0N 128.0E	LRUH														33.6N 130.0E	
92	150018Z	28.0N 128.0E	LRUH														33.6N 129.0E	
93	150020Z	28.0N 127.0E	LRUH														33.6N 130.0E	
94	150022Z	28.0N 127.0E	LRUH														28.4N 129.0E	
95	150024Z	30.0N 127.0E	LRUH														33.6N 140.0E	
96	150026Z	30.0N 127.0E	P	1	30	700	330	05	240	45							33.6N 130.0E	
97	150028Z	29.0N 127.0E	SAT															17
98	150030Z	29.0N 127.0E	SAT															
99	150032Z	29.0N 126.0E	SAT															
100	150034Z	30.0N 126.0E	P	1	15	700	250	60	140	60	35	140	85					17
101	150036Z	30.0N 126.0E	SAT				(14.0/0.5) 0	/S	(230KTS)	NUAA 2								
102	150038Z	31.0N 125.0E	P	5	15	700	280	50	180	90	40	180	120					18
103	150040Z	31.0N 125.0E	SAT				(12.5/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
104	150042Z	31.0N 125.0E	SAT				(13.0/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
105	150044Z	31.0N 125.0E	SAT				(13.5/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
106	150046Z	30.0N 126.0E	SAT				(12.0/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
107	150048Z	31.0N 125.0E	SAT				(12.0/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
108	150050Z	31.0N 125.0E	P	5	5	700	140	05	50	50								18
109	150052Z	31.0N 125.0E	SAT															
110	150054Z	30.0N 126.0E	SAT															
111	150056Z	30.0N 126.0E	LRUH														35.9N 126.0E	
112	150058Z	30.0N 126.0E	LRUH														35.9N 126.0E	
113	150100Z	30.0N 126.0E	LRUH														35.9N 126.0E	
114	150102Z	30.0N 125.0E	LRUH				(13.0/0.5) 0	/M	(1.0/240KTS)	NUAA 2								
115	150104Z	30.0N 125.0E	LRUH														35.9N 126.0E	
116	150106Z	30.0N 126.0E	LRUH														37.5N 127.0E	
117	150108Z	30.0N 126.0E	SAT				(11.0/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
118	150110Z	30.0N 126.0E	SAT				(13.5/0.5) 0	/M	(1.0/240KTS)	PCN 3	UMSP							
119	150112Z	30.0N 126.0E	LRUH															
120	150114Z	30.0N 130.0E	SAT															

FIX NO.	TIME	POSIT	FIA CAT	ACCRY NAV-MET	FIX LVL	FL DIR	MAX OBS SFC WIND	OBS MIN	MIN 700MB	FLT LVL	EYE FORM	OBIEN-TATION	EYE DIA	POSIT OF RADAR	MSW NAME
1	1102130Z	28.0N 167.0E	SAI	(11.5/1.5 /00.5/24HRS)			NUAA 2 (NESS)								
2	1102130Z	28.0N 167.2E	SAI	(11.5/1.5 /00.5/24HRS)			PCN 0 UMSP					(CONF 01)			
3	1102130Z	28.0N 167.2E	SAI	(11.5/1.5 / / HRS)			PCN 0 UMSP								
4	1102130Z	28.0N 167.2E	SAI	(11.5/1.5 / / HRS)			PCN 0 UMSP								
5	1102130Z	28.0N 167.2E	SAI				PCN 0 UMSP								
6	1102130Z	28.0N 167.2E	SAI				PCN 0 UMSP								
7	1102130Z	28.0N 167.2E	SAI				PCN 0 UMSP								
8	1102130Z	29.0N 161.0E	SAI	(12.0/2.0 /00.5/24HRS)			NUAA 2 (NESS)					(CONF 01)			
9	120107Z	29.1N 160.1E	SAI	(12.0/2.0 /00.5/24HRS)			PCN 3 UMSP								
10	120107Z	29.2N 160.3E	SAI	(12.5/2.5 /00.5/24HRS)			PCN 4 UMSP								
11	120107Z	29.4N 160.3E	SAI	(12.5/2.5 /00.5/24HRS)			PCN 4 UMSP								
12	120107Z	29.6N 160.3E	SAI	(12.5/2.5 /00.5/24HRS)			PCN 3 UMSP								
13	120107Z	29.8N 160.3E	SAI	(12.0/2.0 /01.0/24HRS)			NUAA 2					(CONF 02)			
14	130052Z	30.0N 167.0E	SAI	(13.0/3.0 /00.5/24HRS)			PCN 4 UMSP								
15	130052Z	30.1N 167.0E	SAI	(13.0/3.0 /00.5/24HRS)			PCN 3 UMSP								
16	130052Z	30.3N 166.0E	P	5 5 - 70 30 360			PCN 3 UMSP								1
17	130052Z	30.4N 155.0E	P				PCN 3 UMSP								
18	130052Z	30.6N 155.0E	P	5 8 - 190 20 120			PCN 3 UMSP								
19	130052Z	30.8N 155.0E	P				PCN 3 UMSP								
20	140202Z	31.0N 153.3E	SAI	(14.0/2.0 /5 /24HRS)			NUAA 2								2
21	140202Z	31.2N 153.3E	SAI	(14.0/2.0 /5 /24HRS)			PCN 3 UMSP					(CONF 01)			
22	140202Z	31.4N 153.3E	SAI	(14.0/2.0 /5 /24HRS)			PCN 3 UMSP								
23	140202Z	31.6N 153.3E	SAI	(14.0/2.0 /5 /24HRS)			PCN 3 UMSP								
24	140202Z	31.8N 153.3E	SAI	(14.0/2.0 /5 /24HRS)			PCN 3 UMSP								
25	140202Z	32.0N 153.3E	SAI	(14.0/2.0 /5 /24HRS)			NUAA 2					(CONF 01)			
26	140202Z	32.2N 153.3E	SAI	(14.0/2.0 /5 /24HRS)			NUAA 2					(CONF 01)			

THOPICAL STORM JOAN
FIX POSITIONS FOR CYCLONE NO. 12
18 AUG TO 20 AUG

FIX NO.	TIME	POSIT	FIX CAT	ACCRV NAV-MET	Fly LVL	FLT DIR	WIND VFL	MAX OBS SFC WIND	OBS MIN	MIN 700MB	FLY LVL	EYE FORM	DIEN- TATION	EYE DIA	FOSS1 OF RADAR	MSW NMPH					
1	170417Z	20.1N 133.1E	SAI		(11.5/1.5	/01.0/24KRS)		NUAA 2													
2	170318Z	20.0N 134.3E	SAI		(11.5/1.5	/00.5/24KRS)		PCN 5 UMSP													
3	170318Z	19.9N 134.2E	SAI		(11.5/1.5	/0	/24KRS)	PCN 5 UMSP													
4	171017Z	20.3N 132.9E	SAI					PCN 5 UMSP													
5	180010Z	21.0N 131.0E	SAI		(11.5/1.5	/5	/24KRS)	NUAA 2 (NESS)													
6	180017Z	21.0N 131.0E	SAI		(11.5/1.5	/5	/23KRS)	NUAA 2													
7	180303Z	19.3N 130.4E	SAI		(12.0/2.0	/00.5/24KRS)		PCN 3 UMSP													
8	180303Z	19.3N 131.0E	SAI		(12.5/2.5	/01.0/24KRS)		PCN 3 UMSP													
9	181307Z	18.5N 130.0E	SAI					PCN 5 UMSP													
10	181307Z	18.5N 129.9E	SAI					PCN 5 UMSP													
11	182227Z	18.4N 127.7E	P	3	10	700	270	14	200	30	15	200	35	1001	308	12	10	-	-	-	3
12	190111Z	22.0N 124.2E	SAI		(12.0/2.0	/00.5/24KRS)		NUAA 2													
13	190400Z	21.9N 125.9E	SAI		(12.0/2.0	/	/KRS)	PCN 3 UMSP													
14	190430Z	21.7N 123.9E	SAI		(12.0/2.0	/	/KRS)	PCN 3 UMSP													
15	191114Z	23.0N 122.9E	SAI					PCN 5 UMSP													
16	191114Z	23.0N 123.7E	SAI					PCN 5 UMSP													
17	192116Z	20.8N 121.3E	P	10	15	700	120	34	50	157	15	200	490	302	-	-	-	-	-	-	5
18	200013Z	20.5N 121.0E	SAI		(11.5/2.0	/00.5/24KRS)		NUAA 2													
19	200014Z	20.3N 121.0E	SAI		(11.5/2.0	/00.5/24KRS)		NUAA 2 (NESS)													
20	200410Z	21.9N 119.0E	SAI		(11.5/1.5	/	/KRS)	PCN 5 UMSP													
21	200410Z	21.2N 120.0E	SAI		(12.0/2.0	/	/KRS)	PCN 5 UMSP													
22	200430Z	20.5N 118.0E	SAI		(12.0/2.0	/00.5/24KRS)		PCN 5 UMSP													
23	201430Z	20.8N 122.3E	LMUN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
24	210130Z	21.4N 113.2E	LMUN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
25	210430Z	21.4N 112.4E	LMUN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
26	210600Z	21.5N 111.9E	LMUN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

TROPICAL STORM KATE
FIX POSITIONS FOR CYCLONE NO. 13
24 AUG TO 26 AUG

FIX NO.	TIME	POSIT	FIX CAT	ACCRV NAV-MET	FIX LVL	FLI DIR	FLI LVL	WIND	MAX OBS SFC WIND	OBS MIN	MIN 700MB	FLI LVL	EYE FORM	DIEN- TATION	EYE DIA	FOSS1 OF RADAR	MSW NMPH
1	221400Z	19.9N 116.4E	LMUN	-	20701											22.3N 114.2E	
2	221600Z	19.8N 115.0E	LMUN	-	20711											22.3N 114.2E	
3	221630Z	19.4N 114.2E	LMUN	-	20711											22.3N 114.2E	
4	230104Z	19.3N 114.0E	SAI			(12.0/2.0	/01.0/24KRS)		NUAA 2								
5	230514Z	19.2N 114.3E	SAI			(11.5/1.5	/5	/13KRS)	PCN 5 UMSP								
6	230204Z	19.8N 114.2E	LMUN	-	05111											22.3N 114.2E	
7	231200Z	19.2N 113.1E	LMUN	-	05111											22.3N 114.2E	
8	240024Z	18.8N 112.2E	SAI			(13.0/3.0	/01.0/24KRS)		PCN 3 UMSP								
9	240054Z	18.8N 112.5E	SAI			(13.0/3.0	/01.0/24KRS)		NUAA 2 (NESS)								
10	240457Z	18.8N 112.5E	SAI			(13.0/3.0	/0	/24KRS)	PCN 3 UMSP								
11	240457Z	18.8N 112.5E	SAI			(13.0/3.0	/01.0/24KRS)		NUAA 2 (NESS)								
12	240457Z	18.8N 112.5E	SAI			(13.0/3.0	/0	/24KRS)	PCN 3 UMSP								
13	240457Z	18.8N 112.5E	SAI			(13.5/3.5	/02.0/24KRS)		PCN 4 UMSP								
14	241407Z	20.0N 107.3E	SAI						PCN 5 UMSP								
15	241505Z	19.1N 111.3E	SAI						PCN 4 UMSP								
16	241605Z	18.9N 109.9E	SAI						PCN 5 UMSP								
17	250005Z	19.8N 109.4E	SAI			(13.5/3.5	/02.0/	KRS)	PCN 3 UMSP								
18	250005Z	19.8N 109.4E	SAI			(13.5/3.5	/0	/24KRS)	PCN 3 UMSP								
19	250020Z	20.1N 108.0E	SAI			(14.0/4.0	/0	/KRS)	PCN 3 UMSP								
20	250400Z	20.3N 109.0E	SAI			(13.0/3.0	/0	/24KRS)	ESSA 0 (VIRU)								
21	250440Z	20.2N 109.1E	SAI			(12.0/3.0	/01.0/27KRS)		NUAA 2								
22	250440Z	20.2N 109.1E	SAI			(14.0/4.0	/02.0/24KRS)		PCN 2 UMSP								
23	250440Z	21.0N 109.0E	SAI			(13.0/3.5	/00.5/24KRS)		PCN 3 UMSP								
24	251247Z	20.5N 107.6E	SAI						PCN 1 UMSP								

THOPICAL DEPRESSION 14
FIX POSITIONS FOR CYCLONE NO. 14
01 SEP TO 02 SEP

FIX NO.	TIME	POSIT	FIX CAT	ACCRV NAV-MET	FIX LVL	FLI DIR	FLI LVL	WIND	MAX OBS SFC WIND	OBS MIN	MIN 700MB	FLI LVL	EYE FORM	DIEN- TATION	EYE DIA	FOSS1 OF RADAR	MSW NMPH
1	300137Z	19.3N 114.1E	SAI			(11.5/1.5	/00.5/24KRS)		NUAA 2 (NESS)								
2	310217Z	20.5N 111.0E	SAI			(11.5/1.5	/5	/24KRS)	NUAA 2 (NESS)								
3	310233Z	20.3N 111.5E	SAI			(11.5/1.5	/5	/24KRS)	NUAA 2 (NESS)								
4	020103Z	19.7N 106.5E	SAI			(11.5/1.5	/5	/24KRS)	PCN 5 UMSP								
5	020430Z	19.8N 105.7E	SAI			(11.2/2.0	/01.0/24KRS)		PCN 3 UMSP								

03 SEP 10 07 SE

03 SEP 10 07 SE

MAX 0H5

61

TYPHOON NAME
FIA POSITIONS FOR CYCLONE NO. 16
12 SEP 10 14 SEP

FIX NO.	TIME	POSIT	FIA	ACCHY	FIX	FLI	UFS	MAX UBS	UFS	MIN	FLT	ETE	CLCN-	ETE	POSIT	MSA
			CAI	NAV-MET	LVL	DIR	VEL	DRG	RNG	SLP	HGT	T/TO	FLCM	ATION	CLIA	RADAR
1	002455Z	13.8N 134.5E	SAI				(11.0/1.0 / / NRS)		PCN 5 UMSP							
2	002455Z	14.0N 134.5E	SAI				(11.0/1.0 / / NRS)		PCN 5 UMSP							
3	090240Z	13.8N 134.2E	SAI				(11.0/1.0 /S / 4NRS)		PCN 5 UMSP							
4	092237Z	13.3N 130.0E	SAI				(11.0/1.0 / / NRS)		PCN 5 UMSP							
5	110001Z	16.9N 125.0E	SAI				(11.5/1.5 /00.5/24NRS)		PCN 5 UMSP							
6	110001Z	16.1N 125.8E	SAI				(11.0/1.0 / / NRS)		PCN 5 UMSP							
7	110109Z	16.5N 124.5E	SAI				(11.5/1.5 /00.5/24NRS)		NUAA 2	(CCNF 01)						
8	110400Z	16.7N 123.0E	SAI				(11.0/1.0 / / NRS)		PCN 5 UMSP							
9	110400Z	17.0N 124.3E	SAI				(11.5/1.5 /00.5/24NRS)		PCN 5 UMSP							
10	111242Z	16.9N 122.3E	SAI						PCN 5 UMSP							
11	111242Z	16.9N 122.5E	SAI						PCN 5 UMSP							
12	111242Z	17.4N 122.5E	SAI						PCN 5 UMSP							
13	111842Z	16.8N 121.0E	SAI						PCN 5 UMSP							
14	111842Z	17.0N 121.4E	SAI						PCN 5 UMSP							
15	122442Z	17.0N 119.5E	SAI				(12.0/2.0 /00.5/24NRS)		PCN 5 UMSP							
16	122442Z	16.5N 119.8E	SAI				(12.5/2.5 /01.5/24NRS)		PCN 5 UMSP							
17	122442Z	16.9N 119.5E	SAI				(12.8/2.0 /00.5/24NRS)		PCN 5 UMSP							
18	122000Z	16.8N 119.0E	SAI				(11.8/1.5 /S /24NRS)		NUAA 2	(CCNF 02)						
19	120317Z	17.9N 119.3E	SAI				(12.0/2.0 /0 / NRS)		ESSA 8 (VIBU)							
20	120328Z	17.3N 118.8E	SAI				(12.5/2.5 /01.5/24NRS)		PCN 5 UMSP							
21	120340Z	17.7N 118.4E	SAI				(12.0/2.0 /00.5/ NRS)		PCN 5 UMSP							
22	120340Z	17.6N 118.8E	SAI				(12.5/2.5 /01.5/24NRS)		PCN 5 UMSP							
23	120400Z	17.8N 118.8E	SAI				(12.5/2.5 /01.0/24NRS)		PCN 5 UMSP							
24	120400Z	17.8N 119.0E	LMUH				- POSSIBLE CENTER, 40		PCN 5 UMSP							
25	121030Z	18.3N 117.4E	P	10	8	700	50	40	30	15						
26	121224Z	18.1N 117.0E	SAI						PCN 4 UMSP							
27	121224Z	18.3N 116.9E	SAI						PCN 4 UMSP							
28	121224Z	18.2N 117.0E	SAI						PCN 5 UMSP							
29	121500Z	18.2N 117.0E	P	5	3	700	150	60	20	25						
30	121824Z	18.3N 116.2E	SAI						PCN 5 UMSP							
31	121824Z	18.3N 116.4E	SAI						PCN 5 UMSP							
32	121824Z	18.6N 116.4E	SAI						PCN 5 UMSP							
33	122210Z	18.4N 115.0E	P	30	5	700	150	60	90	25						
34	122330Z	18.3N 114.8E	LMUH				- 2057 / EYE UPEN TO SURF									
35	130000Z	18.6N 114.7E	LMUH													
36	130103Z	18.7N 114.7E	SAI				(14.5/4.5 /03.0/24NRS)		NUAA 2	(CCNF 01)						
37	130106Z	18.7N 114.6E	SAI				(14.5/4.5 /01.5/24NRS)		NUAA 2 (NESS)	(CCNF 01)						
38	130106Z	18.7N 114.7E	SAI				(12.5/2.5 /01.0/24NRS)		PCN 1 UMSP							
39	130100Z	18.7N 114.6E	SAI				(14.0/4.0 /02.0/25NRS)		PCN 1 UMSP							
40	130150Z	18.6N 114.4E	LMUH				- 2051 /									
41	130300Z	18.6N 114.1E	LMUH				- 2051 /									
42	130321Z	18.7N 114.3E	SAI				(13.0/3.0 /01.0/25NRS)		ESSA 8 (VIBU)							
43	130513Z	18.8N 113.8E	SAI				(14.5/4.5 /02.0/24NRS)		PCN 1 UMSP							
44	130513Z	18.8N 113.7E	SAI				(14.0/4.0 /02.0/ NRS)		PCN 1 UMSP							
45	130800Z	18.7N 113.5E	LMUH													
46	130900Z	18.9N 113.1E	P	5	3	700	170	60	90	10	100	90	20	964	281	2
47	130900Z	18.9N 112.9E	LMUH													
48	131200Z	18.9N 112.3E	LMUH													
49	131347Z	18.8N 111.6E	SAI						PCN 2 UMSP							
50	131347Z	19.2N 112.4E	SAI						PCN 2 UMSP							
51	131510Z	18.9N 111.7E	LMUH													
52	131750Z	18.9N 111.0E	SAI						PCN 2 UMSP							
53	131750Z	18.2N 111.0E	SAI						PCN 2 UMSP							
54	140000Z	18.9N 109.3E	SAI				(14.0/4.0 /W /24NRS)		PCN 3 UMSP							
55	140150Z	19.1N 109.1E	SAI				(13.5/4.5 /W1.0/25NRS)		NUAA 2	(CCNF 01)						
56	140437Z	19.3N 108.5E	SAI				(15.0/4.0 /W /24NRS)		PCN 3 UMSP							
57	140437Z	19.3N 108.5E	SAI				(15.0/3.0 /S0.5/24NRS)		PCN 3 UMSP							
58	141327Z	19.1N 107.6E	SAI						PCN 5 UMSP							
59	141742Z	19.2N 106.9E	SAI						PCN 5 UMSP							
60	150444Z	19.1N 102.4E	SAI				(15.0/3.0 / / NRS)		PCN 5 UMSP							

02 OCT 10 10 00
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44 OCT 10 08

TYPHOON PATSY FIX POSITIONS FOR CYCLONE NO. 19																
FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	Fix LVI	FLI LVL DIR	IND BNC	MAX OBS SFC WIND VEL	OBS MIN SLP	MIN MGT	FLT LVL/TU	EYE FORM	CLOUD	EYE DIA	FUSION OF RADAR	MSA MMRP
1	050019Z	14.5N 143.0E	SAI	(T1.5/1.5 /D0.5/24HRS)				NUAA 2 (NESS)	(CCNF 02)							
2	052316Z	13.5N 142.4E	SAI	(T1.5/1.5 /D0.5/24HRS)				PCN 3 UMSP								
3	052315Z	13.5N 142.0E	SAI	(T2.0/2.0 /D0.5/24HRS)				NUAA 2 (NESS)								
4	060301Z	13.5N 142.1E	SAI	(T1.5/1.5 /D0.5/24HRS)				PCN 3 UMSP								
5	061153Z	13.5N 142.0E	SAI	(T1.5/1.5 /D0.5/24HRS)				PCN 3 UMSP								
9	082235Z	12.5N 141.3E	SAI	(T3.0/3.0 /D1.5/24HRS)				PCN 3 UMSP								
8	010001Z	12.5N 141.7E	SAI	(T3.5/3.5 /D1.5/24HRS)				NUAA 2 (NESS)	(CCNF 02)							
9	070001Z	12.5N 141.2E	SAI	(T3.5/3.5 /D1.5/24HRS)				NUAA 2 (NESS)	(CCNF 01)							
10	070541Z	12.5N 140.5E	SAI	(T3.0/3.0 /D1.5/24HRS)				PCN 4 UMSP								
12	070310Z	13.5N 141.0E	P	2 8 - 150 50 50				40 50 40 30 - - - - CIRC						50		2
13	071000Z	13.5N 140.0E	P	10 2 - 150 50 50				35 - - - - - - - - CIRC						50		2
14	071135Z	13.5N 140.5E	SAI					PCN 3 UMSP								
15	071530Z	13.5N 139.5E	SAI					PCN 3 UMSP								
16	071530Z	14.1N 139.5E	SAI					PCN 3 UMSP								
17	071530Z	14.1N 139.5E	SAI					PCN 3 UMSP								
18	072235Z	14.0N 139.2E	SAI	(T2.0/2.0 /D1.0/24HRS)				NUAA 2 (NESS)	(CCNF 01)							
19	072235Z	14.0N 139.2E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 1 UMSP								
20	072235Z	14.0N 139.2E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 1 UMSP								
21	082235Z	13.5N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				NUAA 2 (NESS)	(CCNF 01)							
22	082235Z	13.5N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 4 UMSP								
23	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
24	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
25	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
26	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
27	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
28	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
29	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
30	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
31	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
32	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
33	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
34	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
35	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
36	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
37	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
38	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
39	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
40	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
41	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
42	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
43	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
44	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
45	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
46	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
47	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
48	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
49	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
50	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
51	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
52	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
53	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
54	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
55	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
56	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
57	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
58	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
59	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
60	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
61	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
62	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
63	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
64	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
65	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
66	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
67	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
68	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
69	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
70	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
71	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
72	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
73	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
74	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
75	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
76	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
77	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
78	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
79	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
80	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
81	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
82	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
83	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
84	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)				PCN 3 UMSP								
85	082235Z	14.1N 138.5E	SAI	(T2.0/2.0 /D1.0/24HRS)												

TYPHOON KATH
FIX POSITIONS FOR CYCLONE NO. 20

11 OCT 10 19 OCT																		
MAX OBS MAX OBS																		
FIX NO.	TIME	POSIT	LAT	ACCHY	FIX LVL	FLI DIR	LVL VEL	WIND RNG	SFC WIND VEL	WIND RNG	OBS MIN	MIN HGT	FLT LVL	EYE FORM	DIEN- TION	EYE DIA	POSIT OF RADAR	MSA NMPS
1	110300Z	10.2N 140.4E	SAI	(11.5/1.5 /00.5/24MRS)	PCN 5	UMSP												
2	110330Z	10.2N 139.7E	SAI	(11.5/1.5 /00.5/24MRS)	PCN 5	UMSP												
3	110400Z	12.0N 138.5E	SAI		PCN 5	UMSP												
4	110430Z	12.1N 140.5E	SAI		PCN 5	UMSP												
5	110500Z	12.0N 140.0E	AC H	-														
6	110530Z	12.2N 139.9E	SAI		PCN 5	UMSP												
7	110600Z	11.0N 137.2E	SAI	(12.0/2.0 /01.0/24MRS)	NOAA 2	(NESS)	(CONF 02)											
8	110630Z	12.0N 137.0E	SAI	(12.5/2.5 /01.5/24MRS)	NOAA 2	(NESS)	(CONF 02)											
9	110700Z	12.0N 137.4E	SAI	(12.5/2.5 /01.0/24MRS)	PCN 3	UMSP												
10	110730Z	12.0N 137.3E	SAI	(13.0/3.0 /00.5/11MRS)	PCN 3	UMSP												
11	120000Z	13.3N 137.7E	P	5 3 - 100 30 40	50 35 40	15	995	-	23 24	-	-	-					2	
12	120030Z	13.1N 137.4E	P	5 3 - 100 30 360	50 35 360	15	995	-	23 24	-	-	-					2	
13	120100Z	13.1N 137.1E	SAI	(12.5/2.5 /01.0/ MRS)	PCN 3	UMSP												
14	120130Z	13.2N 135.1E	SAI		PCN 3	UMSP												
15	120200Z	14.0N 134.7E	P	2 20 - 150 41 100	15 -	-	-	1001	309	10 14	-	-	-				3	
16	120230Z	14.0N 134.7E	P	2 15 - 110 44 30	25 -	-	-	996	305	10 -	-	-	-				3	
17	120300Z	14.1N 134.2E	SAI		PCN 3	UMSP												
18	120330Z	13.4N 134.2E	SAI		PCN 3	UMSP												
19	120400Z	13.7N 132.3E	SAI	(13.0/3.0 /00.5/24MRS)	PCN 3	UMSP												
20	120430Z	12.7N 132.3E	SAI		PCN 3	UMSP												
21	120500Z	12.0N 132.0E	SAI	(13.5/3.5 /00.5/24MRS)	PCN 4	UMSP												
22	120530Z	12.0N 133.0E	SAI	(13.5/3.5 /01.5/25MRS)	NOAA 2	(CONF 01)												
23	120600Z	12.0N 132.0E	SAI	(13.5/3.5 /01.0/24MRS)	NOAA 2	(NESS)	(CONF 02)											
24	120630Z	12.7N 131.0E	SAI	(13.0/3.0 /00.5/ MRS)	PCN 3	UMSP												
25	120700Z	12.7N 131.7E	SAI	(13.5/3.5 /00.5/ MRS)	PCN 4	UMSP												
26	120730Z	12.7N 132.0E	P	10 2 700 110 55 360	15 80 360	17	975	290	11 14	CIRC							4	
27	120800Z	13.1N 130.7E	P	10 5 700 100 50 30	30 80 30	25	982	292	10 13	CIRC							4	
28	120830Z	13.1N 130.7E	SAI		PCN 3	UMSP												
29	120900Z	13.0N 130.0E	SAI		PCN 4	UMSP												
30	120930Z	13.4N 130.0E	SAI		PCN 3	UMSP												
31	121000Z	13.0N 130.0E	SAI		PCN 3	UMSP												
32	121030Z	13.0N 130.2E	P	5 10 - 40 30 330	30 -	-	-	-	11 -	CIRC							5	
33	120100Z	13.7N 129.0E	P	5 5 - 120 54 50	60 -	-	-	-	10 -	CIRC							5	
34	120130Z	13.7N 129.0E	SAI	(13.5/3.5 /02.5/ MRS)	PCN 3	UMSP												
35	120200Z	14.0N 128.0E	SAI	(14.0/4.0 /01.0/24MRS)	PCN 3	UMSP												
36	120230Z	14.0N 128.0E	SAI	(13.0/3.5 /00.5/25MRS)	NOAA 2	(CONF 01)												
37	120300Z	14.0N 128.2E	SAI	(14.0/4.0 /01.0/24MRS)	NOAA 2	(NESS)												
38	120330Z	14.0N 128.1E	SAI	(14.0/4.0 /01.0/24MRS)	PCN 5	UMSP												
39	120400Z	14.0N 127.8E	P	5 10 700 60 65 350	40 60 350	35	987	298	10 14	-	-	-					6	
40	120430Z	14.0N 127.8E	SAI	(13.5/3.5 /02.5/ MRS)	PCN 3	UMSP												
41	120500Z	14.0N 126.6E	P	5 10 700 30 65 260	50 65 260	70	983	294	11 -	CIRC							7	
42	120530Z	14.0N 126.6E	SAI		PCN 5	UMSP												
43	120600Z	14.0N 126.0E	SAI		PCN 3	UMSP												
44	120630Z	14.0N 126.0E	P	5 10 700 110 65 20	50 -	-	982	294	20 -	CIRC							7	
45	120700Z	14.0N 126.0E	SAI		PCN 4	UMSP												
46	120730Z	14.0N 126.3E	SAI		PCN 1	UMSP												
47	120800Z	14.0N 125.2E	LMUK	- EYE, 10 DEG SPIRAL OVERLAY, 100 PCT, ELLIPTICAL, AXIS 44X32														14.4N 122.6E
48	120830Z	14.0N 124.0E	LMUK	- EYE, 90 PCT, CIRCULAR OPEN SW, 032														14.4N 122.6E
49	120900Z	14.0N 124.0E	SAI	(14.5/4.5 /00.5/24MRS)	PCN 3	UMSP												
50	120930Z	14.0N 124.0E	SAI		PCN 3	UMSP												
51	121000Z	14.0N 124.2E	SAI	(15.5/5.5 /02.0/ MRS)	PCN 1	UMSP												
52	121030Z	14.0N 124.7E	LMUK	- EYE, 75 PCT, CIRCULAR OPEN N, 060														14.4N 122.6E
53	121100Z	14.0N 124.0E	LMUK	- EYE, 75 PCT, CIRCULAR OPEN SW, 032														14.4N 122.6E
54	121130Z	14.0N 124.0E	SAI	(15.0/5.0 /02.0/25MRS)	NOAA 2	(NESS)	(CONF 01)											
55	121200Z	14.0N 124.0E	SAI		PCN 3	UMSP												
56	121230Z	14.0N 124.1E	LMUK	- EYE, 70 PCT, CIRCULAR OPEN N, 065														14.4N 122.6E
57	121300Z	14.0N 124.2E	P	10 10 700 350 70 250	15 70 250	60	972	286	10 12	CIRC							8	
58	121330Z	14.0N 124.0E	LMUK	- EYE, 70 PCT, CIRCULAR OPEN N, 055														14.4N 122.6E
59	121400Z	14.0N 123.0E	SAI	(14.0/4.0 /00.5/ MRS)	PCN 1	UMSP												
60	121430Z	14.0N 123.0E	SAI	(14.5/4.5 /00.5/ MRS)	PCN 1	UMSP												
61	121500Z	15.0N 122.7E	LMUK	- 67/71														14.4N 120.6E
62	121530Z	15.1N 122.7E	P	5 5 700 110 65 20	54 65 20	40	961	277	10 13	CIRC							14.4N 120.6E	
63	121600Z	15.1N 122.7E	LMUK	- 61/30														14.4N 120.6E
64	121630Z	15.3N 122.5E	LMUK	- 32/41														14.4N 120.6E
65	121700Z	15.0N 122.3E	LMUK	- EYE														14.4N 120.6E
66	121730Z	15.0N 122.1E	LMUK	- 20/70														14.4N 120.6E
67	121800Z	15.0N 122.1E	LMUK	- EYE														14.4N 120.6E
68	121830Z	15.0N 122.0E	SAI		PCN 1	UMSP												
69	121900Z	15.0N 122.0E	SAI		PCN 1	UMSP												
70	121930Z	15.0N 122.0E	LMUK	- 20/71														14.4N 120.6E
71	121930Z	15.0N 121.0E	LMUK															14.4N 120.6E
72	121930Z	15.0N 121.0E	LMUK	- EYE, 100 PCT, CIRCULAR, 033														14.4N 120.6E
73	121930Z	15.0N 121.0E	LMUK	- 22/11														14.4N 120.6E
74	121930Z	15.0N 120.0E	LMUK	- POSSIBLE EYE, 100 PCT, CIRCULAR, 020														14.4N 120.6E
75	121930Z	15.0N 120.0E	LMUK	- 11/11														14.4N 120.6E
76	121930Z	15.0N 120.0E	LMUK															14.4N 120.6E
77	121930Z	15.0N 120.0E	P	3 15 - 80 85 360	35 -	-	-	-	-	1	CIRC						10	
78	121930Z	15.0N 120.7E	LMUK	- POSSIBLE EYE, 024														18.2N 120.5E
79	121930Z	15.0N 120.7E	SAI		PCN 1	UMSP												14.4N 120.6E
80	121930Z	15.0N 120.0E	LMUK	- 10/11										</				

TYPHOON RUTH
FIX POSITIONS FOR CYCLONE NO. 20
11 OCT TO 19 OCT

FIX NO.	TIME	POSIT	MAC OBS								SFC OBS			OBS SLP	MIN 700MB HGT	FLT TI/TO	EYE FORM	OBTEN- TATION	EYE DIA	POSIT OF RADAR	MSA NAME
			FIX CAT	ACCHY	FIX LVL	FLI DIR	FLI VEL	FLI LVL	WIND BRG	RNG	VEL	BRG	RNG								
101	102100Z	16.0N 115.2E	P	5	5	700	130	74	60	35	-	-	-	966	281	10 14	CIRC		21		12
102	170500Z	16.0N 114.3E	SAT								PCN 1	DMSP									
103	170130Z	16.0N 114.3E	SAT								NOAA 2	(NESS)	(CONF 01)								
104	170410Z	16.0N 114.3E	SAT								NOAA 2	(NESS)	(CONF 01)								
105	170340Z	16.0N 113.8E	SAT								PCN 3	DMSP									
106	170340Z	16.0N 113.8E	SAT								PCN 5	DMSP									
107	170340Z	16.0N 113.8E	SAT								PCN 5	DMSP									
108	170500Z	16.0N 112.0E	SAT								PCN 3	DMSP									
109	170500Z	16.0N 112.0E	P	5	15	700	150	90	70	80	40	70	100	957	273	10 14	CIRC		40		13
110	171000Z	16.0N 111.0E	P	5	8	700	130	100	40	30	-	-	-	960	274	10 11	CIRC		35		13
111	171000Z	16.0N 111.0E	SAT								PCN 5	DMSP									
112	171000Z	16.0N 111.0E	SAT								PCN 1	DMSP									
113	171000Z	16.0N 111.0E	SAT								PCN 3	DMSP									
114	170600Z	16.0N 111.0E	P	5	5	700	-	-	-	-	-	-	-	960	276	10 11	CIRC		33		14
115	170300Z	16.0N 110.0E	SAT								PCN 1	DMSP									
116	180000Z	16.0N 110.0E	SAT								ESSA 4 (VTBU)										
117	180000Z	16.0N 110.0E	SAT								NOAA 2	(NESS)	(CONF 02)								
118	180000Z	16.0N 110.0E	SAT								PCN 5	DMSP									
119	180000Z	16.0N 110.0E	SAT								PCN 5	DMSP									
120	180000Z	16.0N 107.0E	SAT								PCN 4	DMSP									
121	180000Z	16.0N 108.0E	SAT								NOAA 2	(NESS)	(CONF 02)								
122	180000Z	16.0N 108.0E	SAT								NOAA 2	(NESS)	(CONF 02)								
123	180000Z	16.0N 108.0E	SAT								NOAA 2	(NESS)	(CONF 02)								
124	180000Z	16.0N 108.0E	SAT								PCN 1	DMSP									

TROPICAL STORM SARAH
FIX POSITIONS FOR CYCLONE NO. 21

FIX NO.	TIME	POSIT	FIX CAT	ACCHY	FIX LVL	FLI DIR	FLI VEL	FLI LVL	WIND BRG	RNG	MAX OBS SFC WIND VEL	MAX OBS WIND BRG	RNG	OBS SLP	MIN SLP	700MB HGT	FLT TI/TO	EYE FORM	OBTEN- TATION	EYE DIA	POSIT OF RADAR	MSA NAME
1	000040Z	10.0N 115.5E	SAT								NOAA 2	(NESS)	(CONF 02)									
2	000040Z	10.0N 115.5E	SAT								NOAA 2	(NESS)	(CONF 01)									
3	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
4	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
5	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
6	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
7	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
8	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
9	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
10	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
11	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
12	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
13	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
14	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
15	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
16	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
17	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
18	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
19	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
20	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
21	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
22	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
23	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
24	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
25	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
26	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
27	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
28	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
29	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
30	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
31	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
32	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
33	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
34	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
35	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
36	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
37	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									
38	000140Z	11.0N 115.0E	SAT								NOAA 2	(NESS)	(CONF 01)									

TROPICAL STORM ITHMA
FIX POSITIONS FOR CYCLONE NO. 22

		15 NOV 05 18 NOV																					
FIX NO.	TIME	POSIT	FIX CAT	ACCHY	FIX LVL	FLI DIR	FLI VEL	FLI LVL	WIND BRG	RNG	MAX OBS SFC WIND VEL	MAX OBS WIND BRG	RNG	OBS SLP	MIN SLP	700MB HGT	FLT TI/TO	EYE FORM	OBTEN- TATION	EYE DIA	POSIT OF RADAR	MSA NAME	
1	100040Z	9.1N 132.5E	SAT			(T1.5/1.5	/U0.5/24MRS				NOAA 2			(CONF 01)									
2	100040Z	9.1N 132.5E	SAT			(T1.5/1.5	/U0.5/24MRS				NOAA 2	(NESS)		(CONF 02)									
3	100240Z	9.1N 130.8E	SAT			(T1.5/1.5	/S /23MRS																
4	100300Z	9.1N 125.5E	SAT			(T2.0/2.0	/U0.5/25MRS				NOAA 2	(NESS)		(CONF 02)									
5	100440Z	9.1N 120.5E	SAT			(T2.0/2.0	/U0.5/25MRS				NOAA 2	(NESS)		(CONF 01)									
6	100530Z	9.1N 121.0E	SAT			(T3.0/3.0	/U1.0/25MRS				NOAA 2	(NESS)		(CONF 02)									
7	100530Z	9.1N 121.0E	SAT			(T3.0/3.0	/U1.0/25MRS				NOAA 2	(NESS)		(CONF 02)									
8	100630Z	10.1N 117.4E	SAT			(T3.5/3.5	/U0.5/25MRS				NOAA 2	(NESS)		(CONF 02)									
9	100630Z	10.1N 117.4E	SAT			(T3.0/3.0	/S /23MRS				NOAA 2	(NESS)		(CONF 02)									
10	100830Z	10.1N 118.1E	SAT			(T1.5/1.5	/S /25MRS				PCN 5	DMSP											
11	100830Z	10.1N 118.2E	SAT			(T1.5/1.5	/S /25MRS				PCN 5	DMSP											
12	101130Z	12.0N 112.8E	SAT								PCN 5	DMSP											
13	101200Z	12.0N 112.8E	SAT								PCN 3	DMSP											
14	100830Z	10.1N 117.4E	SAT			(T1.5/1.5	/S /25MRS				PCN 3	DMSP											
15	100830Z	10.1N 117.3E	SAT			(T3.0/3.0	/ /25MRS				PCN 3	DMSP											
16	101412Z	10.1N 110.0E	SAT			(T3.5/3.5	/S /25MRS				NOAA 2	(CONF 01)											
17	101200Z	10.0N 110.0E	SAT			(T3.5/3.5	/U0.5/24MRS				NOAA 2	(NESS)											
18	100830Z	9.1N 119.7E	P	5		(T3.0/3.0	/ 150, 50 MRS	60			20	30	DMSP	20	993	304	1	15	-	-	-	1	
19	100830Z	10.0N 119.7E	P	1		(T3.0/3.0	/U1.5/25MRS	90	60	360	15	60	DMSP	10	991	301	18	17	-	-	-	1	
20	100830Z	9.1N 119.7E	P	1		(T3.0/3.0	/U1.5/25MRS	90	60	360	15	60	DMSP	10	991	301	18	17	-	-	-	1	
21	100830Z	9.1N 119.7E	P	1		(T3.0/3.0	/U1.5/25MRS	90	60	360	15	60	DMSP	10	991	301	18	17	-	-	-	1	
22	101310Z	9.1N 119.7E	SAT								PCN 5	DMSP											
23	101310Z	9.1N 119.7E	SAT								PCN 5	DMSP											
24	101500Z	9.1N 119.7E	SAT								PCN 5	DMSP											
25	100017Z	9.1N 118.0E	SAT			(T3.0/3.0	/U1.5/24MRS				PCN 5	DMSP											
26	100017Z	9.1N 118.0E	SAT			(T3.0/3.0	/U1.5/24MRS				PCN 5	DMSP											
27	100017Z	9.1N 118.0E	SAT			(T2.0/2.0	/U1.0/24MRS				PCN 3	DMSP											
28	100230Z	9.1N 107.0E	SAT			(T2.5/3.5	/U1.0/24MRS				NOAA 2	(NESS)											
29	100220Z	9.1N 107.0E	SAT			(T2.5/3.5	/U1.0/25MRS				NOAA 2	(CONF 01)											
30	100500Z	9.1N 107.0E	SAT			(T1.5/2.5	/U1.5/24MRS				PCN 3	DMSP											
31	100530Z	9.1N 107.0E	SAT			(T2.0/2.0	/U1.0/24MRS				PCN 3	DMSP											
32	101012Z	9.1N 108.0E	P	-		(T2.0/2.0	/U1.0/24MRS	-			PCN 3	DMSP	-										
33	101130Z	9.1N 108.0E	P	-		(T2.0/2.0	/U1.0/24MRS	-			PCN 3	DMSP	-										
34	101130Z	9.1N 108.0E	P	-		(T2.0/2.0	/U1.0/24MRS	-			PCN 3	DMSP	-										
35	101220Z	9.1N 108.0E	SAT			(T1.5/2.5	/U1.0/23MRS				NOAA 2	(CONF 02)											
36	101220Z	9.1N 108.0E	SAT			(T1.5/2.5	/U1.0/23MRS				NOAA 2	(CONF 02)											
37	101220Z	9.1N 108.0E	SAT			(T1.5/2.5	/U1.0/23MRS				NOAA 2	(CONF 02)											
38	100610Z	10.0N 100.0E	SAT			(T2.0/2.0	/U0.5/25MRS				NOAA 2	(CONF 02)											
39	100610Z	10.0N 100.0E	SAT			(T1.5/1.5	/U0.5/25MRS				NOAA 2	(NESS)											

19 NOV 10 26 NOV

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CHAPTER V — SUMMARY OF FORECAST VERIFICATION DATA

I. COMPARISON OF OBJECTIVE TECHNIQUES

a. GENERAL:

Objective techniques have been verified yearly since 1967. Year-to-year modifications and improvements have prevented any long period comparisons of the various objective techniques except for EXTRAPOLATION and ARAKAWA (1963). All of the dynamic objective forecast techniques used during the past season employed the simple steering concept of a point vortex in a smoothed flow field with adjustments based on past movement. None of the techniques provided intensity forecasts with their associated relationship to movement.

b. DISCUSSION OF OBJECTIVE TECHNIQUES:

(1) EXTRAPOLATION - Past 12-hour movement derived from current warning position and 12-hour old best track position is linearly extrapolated to 24 and 48 hours.

(2) ARAKAWA (1963) - Grid overlay values of surface pressure are entered into regression equations. Previously hand computed, computations were computerized during the latter half of the 1972 season.

(3) MOHATT 850/700 - A modification to the basic HATRACK program which advects a point vortex on a pre-selected analysis or prognostic SR (space mean) field at designated levels in six-hour time steps out through 84 hours. Utilizing the 12-hour history position, MOHATT computes the previous 12-hour forecast error and applies a bias correction to the forecasted positions out to 72 hours.

(4) TYMOD 12/24 - A modification to FLEWEACEN Pearl Harbor's objective technique TSGLOB. TYMOD advects a weighted point source using FNWC Monterey's global band upper air progs out to 72 hours. Outputs are provided for both 12- and 24-hour history. Bias corrections are applied to the forecast positions based on the previous 12- and 24-hour forecast errors.

(5) TYFOON-72 - Modified version (Jarrell and Wagoner, 1973) of the basic TYFOON program (Jarrell and Somervell, 1970). The program outputs forecast positions as the centers of probability ellipses out to 72 hours based on a group of analog storms which occurred within a time/

space envelope centered about the date and position of the storm being forecast. Ellipses are based on the analog population weighted according to their similarity to the existing storms.

c. TESTING AND RESULTS:

In past years only one or two objective techniques provided 72-hour forecasts. For the first time, during 1973, the JTWC had five objective techniques to assist in formulating the 72-hour outlook. Although some of the objective techniques showed certain skill at various time frames, research is continuing in an effort to improve all of the objective techniques used by the JTWC.

(1) Table 5-1 presents a comparison of all objective techniques for all forecasts. Each objective technique is compared to the best track, each of the other objective techniques, and the official JTWC forecast. A comparison of the various techniques shows EXTRAPOLATION to be superior to all other techniques at both 24 and 48 hours. When compared to the official JTWC forecast, EXTRAPOLATION was only slightly higher at 24 hours and equal at 48 hours. TYFOON-72 was the second best technique at 24 and 48 hours and superior to the other techniques at 72 hours. When compared to the official JTWC forecast at 72 hours, TYFOON-72 was only slightly higher.

(2) Table 5-2 presents a comparison of all objective techniques for all typhoons where the maximum sustained surface wind was 35 knots or greater. Once again, EXTRAPOLATION was superior to all other techniques at both 24 and 48 hours and TYFOON-72 was best at 72 hours. When compared to the official JTWC forecast, however, EXTRAPOLATION was equal at 24 hours and slightly better at 48 hours. This indicates the regular tracks most typhoons described once they became well developed plus the lack of major recurvers during the 1973 season.

II. SUMMARY OF TROPICAL CYCLONE FORMATION ALERTS

For the fourth consecutive year, the JTWC issued Tropical Cyclone Formation Alert messages as a means of alerting Department of Defense interests to potentially dangerous tropical disturbances which normally had not reached the tropical depression stage.

Of the 26 tropical disturbances in the western North Pacific during 1973 for which alerts were issued, 22 were placed in warning status. Only Tropical Storm Hope, which developed from an upper tropospheric low, was not preceded by a formation alert. Including revisions, extensions, and regenerations a total of 43 formation alert messages were issued.

The high ratio of tropical cyclones to formation alerts, 85%, can be attributed to the improved satellite interpretation procedures employed by the JTWC. Of the

SUMMARY											
	NO. OF ALERT SYSTEMS	ALERT SYSTEMS WHICH BECAME NUMBERED TROPICAL CYCLONES	TOTAL NUMBERED TROPICAL CYCLONES	DEVELOPMENT RATE							
1970	32	18	27	56%							
1971	48	33	37	69%							
1972	41	29	32	71%							
1973	26	22	23	85%							
MONTHLY DISTRIBUTION											
J	F	M	A	M	J	J	A	S	O	N	D
0	0	0	0	1	1	6	6	5	4	3	0

43 alerts issued, 30 were based solely on satellite data, three on aircraft investigations, and two on synoptic data. The remaining eight alerts were based on a combination of satellite plus aircraft, synoptic data, or land radar. Thus, 88% of all alerts issued during 1973 employed satellite data as their basis.

3. ANNUAL FORECAST VERIFICATION

Forecast positions for the warning, 24-, 48-, and 72-hour forecasts are verified against the best track using two criteria:

a. Only those forecasts for tropical cyclones which reach typhoon intensity and the best track winds are 35 kts or greater are verified; and

b. All forecasts for which best track positions exist are verified.

No verification statistics are computed for the 12-hour forecast positions. However, the 12-hour forecast position errors may be estimated by adding half the difference between the warning and 24-hour forecast position errors to the warning position error.

In addition to the methods described above for verifying absolute error distance, a computation of closest distance to the best track (right angle error) is also calculated for both methods. This is used to measure the demonstrated ability of the JTWC to forecast the path of motion without regard to speed.

Unless otherwise indicated, the following tables and figures depict the distribution of the typhoon criteria forecasting errors in the JTWC forecasts.

TABLE 5-1. JTWC ANNUAL AVERAGE FORECAST ERROR

	24-HR	48-HR	72-HR
1950-58	170	---	---
1959	*117	*267	---
1960	177	354	---
1961	136	274	---
1962	144	287	476
1963	127	246	374
1964	133	284	429
1965	151	303	418
1966	136	280	432
1967	125	276	414
1968	105	229	337
1969	111	237	349
1970	98	181	272
1971	99	203	308
1972	116	245	382
1973	102	193	245

*Forecast positions north of 35°N were not verified

4. REFERENCES

- Arakawa, H., "Statistical Method to Forecast the Movement and the Central Pressure of Typhoons in the Western North Pacific," Japan Meteorological Agency, Meteorological Research Institute Final Report, October 1963.
- Jarrell, J.D., and W.L. Somervell, Jr., "A Computer Technique for Using Typhoon Analogs as a Forecast Aid," NAVWEARSCHFAC Tech. Paper No. 6-70, June 1970.
- Jarrell, J.D., and R.A. Wagoner, "The 1972 Typhoon Analog Program (TYFOON-72)," ENVPREDRSCHFAC Tech. Paper No. 1-73, January 1973.

TABLE 5-2. 1973 OBJECTIVE TECHNIQUES VERIFICATION FOR TYPHOONS ONLY (see criterion a)

24-HOUR

	JTWC		XTRP		ARKW		TY24		TY12		TYFN		MH85		MH70	
JTWC	195	102														
	102	0														
XTRP	164	100	164	100												
	100	0	100	0												
ARKW	42	92	40	102	42	120										
	120	28	122	21	120	0										
TY24	144	98	136	97	38	124	144	216								
	216	118	220	123	195	71	216	0								
TY12	150	99	140	97	38	124	142	216	150	181						
	181	82	182	85	166	42	181	-36	181	0						
TYFN	170	99	154	98	41	121	143	215	148	181	170	116				
	116	17	117	19	106	-15	115	-101	115	-65	116	0				
MH85	135	102	129	97	35	124	120	223	126	177	132	119	135	147		
	147	44	146	49	131	8	146	-77	145	-31	145	-26	147	0		
MH70	125	101	119	95	34	126	113	192	118	158	122	105	124	131	125	125
	125	25	124	28	120	-6	123	-69	123	-35	124	20	125	-6	125	0

NUMBER OF CASES	X-AXIS TECHNIQUE ERROR
Y-AXIS TECHNIQUE ERROR	ERROR DIFFERENCE Y-X

48-HOUR

	JTWC		XTRP		ARKW		TY24		TY12		TYFN		MH85		MH70	
JTWC	136	193														
	193	0														
XTRP	120	192	124	191												
	190	-2	191	0												
ARKW	33	187	31	191	33	280										
	280	93	276	85	280	0										
TY24	104	187	102	185	30	283	109	392								
	389	202	395	210	360	77	392	0								
TY12	108	186	106	183	30	283	107	393	115	360						
	352	165	358	175	330	47	356	-37	360	0						
TYFN	125	190	117	189	32	287	108	391	113	357	132	215				
	210	20	214	25	222	-65	203	-189	205	-152	215	0				
MH85	98	196	96	188	27	264	91	400	97	357	101	210	103	312		
	314	118	314	127	266	2	308	-92	311	-46	308	98	312	0		
MH70	92	195	91	186	27	264	87	399	92	355	95	209	97	311	97	291
	294	99	293	107	251	-13	282	-117	288	-67	288	79	291	-20	291	0

JTWC - OFFICIAL JTWC SUBJECTIVE FORECAST
 XTRP - EXTRAPOLATION
 ARKW - ARAKAWA
 TY24 - TYMOD WITH 24-HR HISTORY
 TY12 - TYMOD WITH 12-HR HISTORY
 TYFN - TYFOON (WEIGHTED CLIMO)
 MH85 - MOHATT 850-MB PROG
 MH70 - MOHATT 700-MB PROG

72 HOUR

	JTWC		TY24		TY12		TYFN		MH85		MH70	
JTWC	88	245										
	245	0										
TY24	71	252	76	618								
	616	364	618	0								
TY12	73	247	76	618	80	563						
	546	300	556	-62	563	0						
TYFN	82	246	75	615	79	566	92	291				
	267	21	271	-344	278	-288	291	0				
MH85	63	254	60	613	64	532	6	276	69	513		
	525	270	501	-112	504	-28	507	231	513	0		
MH70	61	254	58	605	62	527	65	277	67	494	67	499
	499	246	477	-128	489	-38	493	216	499	4	499	0

TABLE 5-3. 1973 OBJECTIVE TECHNIQUES VERIFICATION FOR ALL FORECASTS (see criterion b)

24-HOUR

	JTWC		XTRP		ARKW		TY24		TY12		TYFN		MH85		MH70	
JTWC	267	108														
	108	0														
XTRP	218	104	218	109												
	109	5	109	0												
ARKW	45	97	43	110	45	127										
	127	30	130	20	127	0										
TY24	184	102	176	105	41	132	184	208								
	208	106	211	106	201	69	208	0								
TY12	192	103	182	105	41	132	182	208	192	175						
	175	72	175	70	175	43	175	-34	175	0						
TYFN	215	103	198	106	44	128	183	207	190	174	215	120				
	120	16	120	14	112	-16	119	-89	119	-55	120	0				
MH85	161	106	155	105	37	130	143	218	151	176	158	124	161	148		
	148	42	147	42	136	6	147	-71	147	-29	147	23	148	0		
MH70	149	105	143	104	36	132	134	191	141	159	146	112	148	134	149	128
	128	24	127	24	124	-8	126	-65	126	-33	128	15	128	-6	128	0

NUMBER OF CASES	X-AXIS TECHNIQUE ERROR
Y-AXIS TECHNIQUE ERROR	ERROR DIFFERENCE Y-X

48-HOUR

	JTWC		XTRP		ARKW		TY24		TY12		TYFN		MH85		MH70	
JTWC	153	197														
	197	0														
XTRP	137	197	150	201												
	197	0	201	0												
ARKW	33	187	31	191	33	280										
	280	93	276	85	280	0										
TY24	116	192	120	192	30	283	128	398								
	397	205	402	210	360	77	398	0								
TY12	120	192	125	190	30	283	126	399	135	361						
	358	166	361	171	330	47	358	-41	361	0						
TYFN	137	195	136	194	32	287	127	397	133	358	152	212				
	209	14	212	18	222	-65	203	-194	204	-154	212	0				
MH85	105	203	107	196	27	264	101	413	108	367	112	213	114	311		
	311	108	313	117	266	2	308	-105	310	-57	307	95	311	0		
MH70	99	202	102	195	27	264	97	413	103	366	106	212	108	310	108	291
	293	91	293	98	251	-13	285	-128	288	-78	289	76	291	-19	291	0

JTWC - OFFICIAL JTWC SUBJECTIVE FORECAST
 XTRP - EXTRAPOLATION
 ARKW - ARAKANA
 TY24 - TYMOD WITH 24-HR HISTORY
 TY12 - TYMOD WITH 12-HR HISTORY
 TYFN - TYFOON (WEIGHTED CLIMO)
 MH85 - MOHATT 850-MB PROG
 MH70 - MOHATT 700-MB PROG

72 HOUR

	JTWC		TY24		TY12		TYFN		MH85		MH70	
JTWC	97	253										
	253	0										
TY24	79	261	95	617								
	611	350	617	0								
TY12	81	256	95	617	100	577						
	550	294	570	-47	577	0						
TYFN	90	254	94	615	99	579	112	319				
	266	12	305	-310	313	-267	319	0				
MH85	68	264	73	625	78	572	81	325	83	535		
	529	265	521	-104	526	-45	528	203	533	0		
MH70	66	264	70	617	75	571	78	323	80	513	80	526
	506	242	505	-113	519	-52	522	199	526	12	526	0

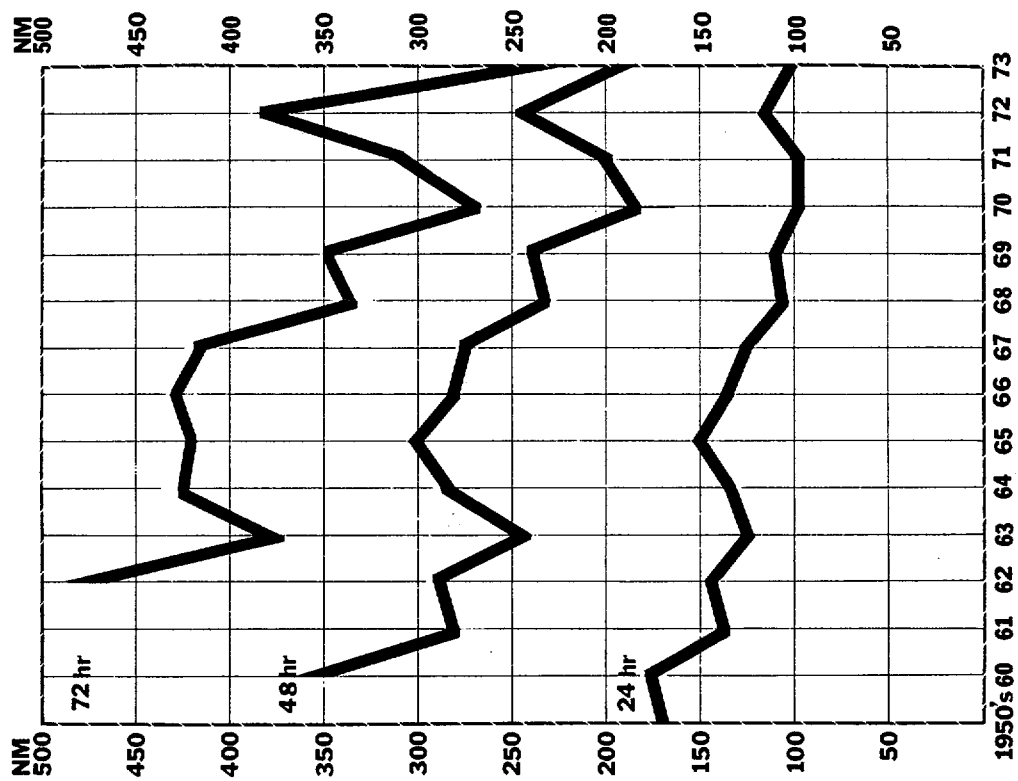


FIGURE 5-1. Mean vector error.

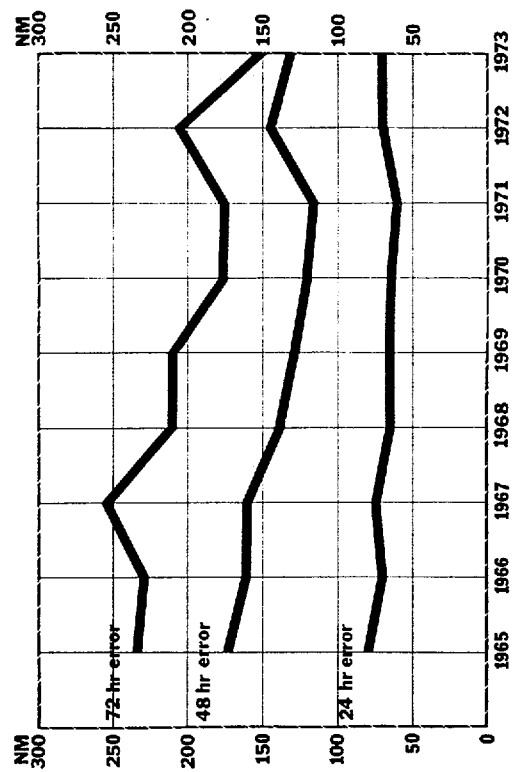


FIGURE 5-2. Mean right angle error.

4. SUMMARY OF INDIVIDUAL TROPICAL STORM VERIFICATION

TABLE 5-4. 1973 JTWC ERROR SUMMARY

(Average errors are given in nautical miles)

CYCLONE	WARNING			24 HOUR			48 HOUR			72 HOUR		
	FCST ERROR	RT ANGLE ERROR	# WRNGS	FCST ERROR	RT ANGLE ERROR	# CASES	FCST ERROR	RT ANGLE ERROR	# CASES	FCST ERROR	RT ANGLE ERROR	# CASES
1. TS WILDA	12	7	9	63	50	5	---	---	---	---	---	---
2. TY ANITA	22	13	13	157	104	9	240	96	3	---	---	---
3. TY BILLIE	20	17	24	79	65	20	151	123	16	210	171	12
4. TS CLARA	28	20	7	92	88	3	---	---	---	---	---	---
5. TY DOT	25	15	19	123	79	11	256	156	2	---	---	---
6. TY ELLEN	17	13	28	135	90	16	201	116	6	55	53	2
7. TS FRAN	58	27	5	172	142	1	---	---	---	---	---	---
8. TY GEORGIA	17	12	15	114	96	11	255	225	7	279	243	1
9. TS HOPE	32	27	13	114	96	9	9	181	155	2	---	---
10. TY IRIS	24	15	30	138	96	26	265	153	21	328	157	17
11. TD 11	23	15	6	155	88	2	---	---	---	---	---	---
12. TS JOAN	65	43	10	191	139	6	---	---	---	---	---	---
13. TS KATE	31	21	8	114	71	4	---	---	---	---	---	---
14. TD 14	16	16	4	---	---	---	---	---	---	---	---	---
15. TY LOUISE	21	14	18	104	71	14	225	180	9	294	173	3
16. TY MARGE	18	10	12	77	67	8	224	166	3	---	---	---
17. TY NORA	17	10	34	104	77	30	192	156	24	267	218	20
18. TY OPAL	26	12	15	98	62	11	177	89	5	---	---	---
19. TY PATSY	21	14	29	65	37	22	212	122	21	318	170	17
20. TY RUTH	19	12	33	84	51	29	126	78	24	163	90	21
21. TS SARAH	13	10	4	---	---	---	---	---	---	---	---	---
22. TS THELMA	35	15	10	146	35	6	263	68	2	283	283	1
23. TS VERA	39	19	28	116	78	24	172	151	8	236	221	3
ALL FORECASTS	24	15	374	108	74	267	197	134	153	253	162	97
*TYPHOONS	19	12	239	102	71	195	193	131	136	245	153	88

*Includes only forecasts on cyclones that became typhoons and only when verifying best track wind was 35 kt.

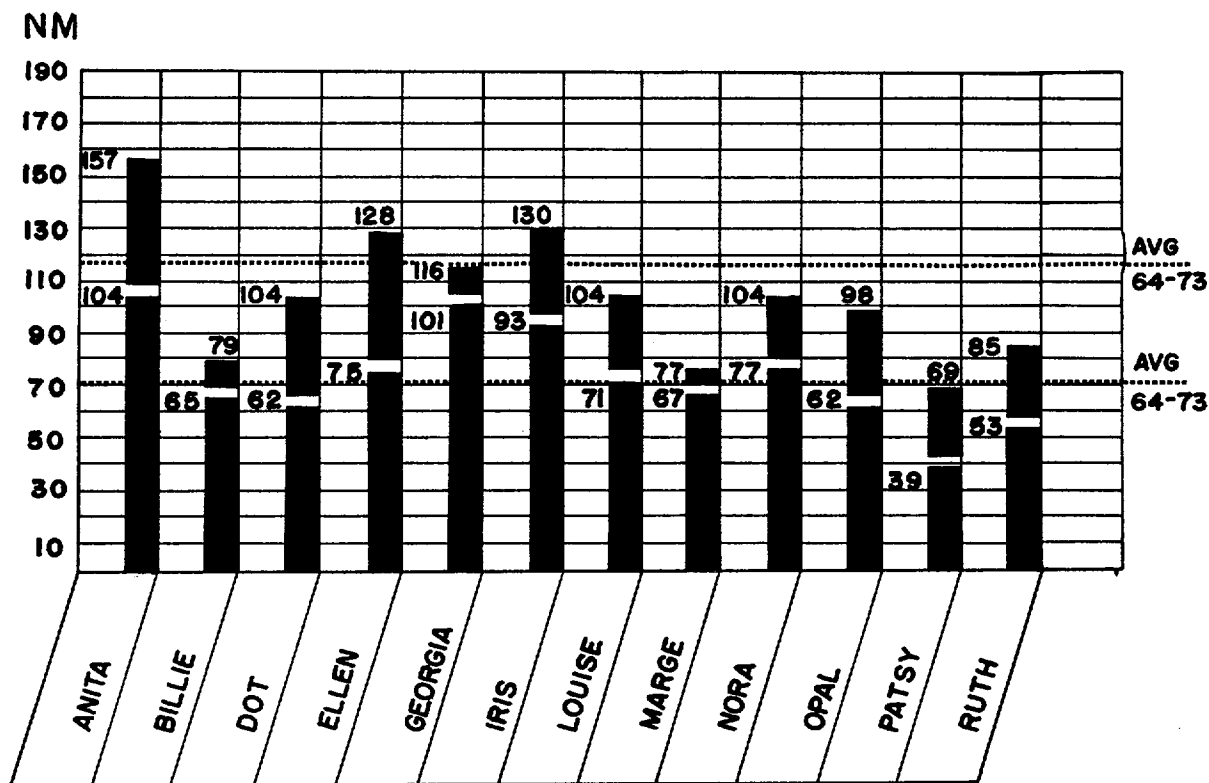


FIGURE 5-3. 1973 average vector and right angle errors of 24-hr forecasts.

5. TROPICAL STORM AND DEPRESSION DATA

TROPICAL STORM WILDA

1200Z 1 JUL TO 1200Z 3 JUL

BEST TRACK		WANNING		ERRORS		24 HOUR FORECAST		48 HOUR FORECAST		72 HOUR FORECAST	
POSIT	WIND	POSIT	WIND	US1 WIND	POSIT	WIND	US1 WIND	POSIT	WIND	POSIT	WIND
011200Z 19.6N 118.3E	45	19.3N 118.0E	30	25 -15	20.6N 115.0E	50	128 -10	---	---	---	---
011800Z 20.3N 118.0E	50	20.2N 118.0E	40	6 -10	22.5N 117.0E	50	39 -10	---	---	---	---
020000Z 20.9N 117.7E	55	20.7N 117.8E	50	13 -5	23.0N 116.8E	65	70 5	---	---	---	---
020600Z 21.5N 117.0E	55	21.3N 117.7E	55	6 0	24.3N 117.9E	45	47 -15	---	---	---	---
021200Z 22.0N 117.7E	50	22.1N 117.7E	55	6 0	25.1N 118.1E	40	32 0	---	---	---	---
021800Z 22.6N 117.7E	60	22.8N 117.7E	55	12 -5	---	---	---	---	---	---	---
030000Z 23.6N 117.9E	60	23.4N 117.9E	50	12 -10	---	---	---	---	---	---	---
030600Z 24.6N 118.3E	60	24.7N 118.2E	40	8 -20	---	---	---	---	---	---	---
031200Z 25.5N 118.5E	40	25.8N 118.5E	40	18 0	---	---	---	---	---	---	---

TROPICAL STORM CLARA

1800Z 12 JUL TO 0600Z 14 JUL

BEST TRACK		WANNING		ERRORS		24 HOUR FORECAST		48 HOUR FORECAST		72 HOUR FORECAST	
POSIT	WIND	POSIT	WIND	US1 WIND	POSIT	WIND	US1 WIND	POSIT	WIND	POSIT	WIND
121800Z 28.1N 161.0E	35	27.6N 161.7E	30	30 -5	30.9N 159.4E	45	57 0	---	---	---	---
130000Z 28.7N 160.9E	40	28.3N 161.0E	30	24 -10	31.4N 159.2E	40	80 0	---	---	---	---
130600Z 29.3N 160.4E	50	29.2N 160.2E	45	12 -5	32.8N 159.2E	50	138 15	---	---	---	---
131200Z 29.8N 160.2E	45	30.0N 159.7E	45	54 0	---	---	---	---	---	---	---
131800Z 30.5N 160.4E	45	30.3N 160.2E	45	16 0	---	---	---	---	---	---	---
140000Z 31.0N 160.7E	40	30.9N 160.2E	45	26 5	---	---	---	---	---	---	---
140600Z 31.7N 161.0E	35	31.8N 161.0E	40	31 5	---	---	---	---	---	---	---

TROPICAL STORM FMAN

0000Z 29 JUL TO 0000Z 30 JUL

BEST TRACK		WANNING		ERRORS		24 HOUR FORECAST		48 HOUR FORECAST		72 HOUR FORECAST	
POSIT	WIND	POSIT	WIND	US1 WIND	POSIT	WIND	US1 WIND	POSIT	WIND	POSIT	WIND
290000Z 18.9N 124.0E	35	19.3N 123.5E	25	37 -10	20.6N 120.0E	45	172 20	---	---	---	---
290600Z 19.5N 123.3E	35	19.3N 123.6E	35	18 0	---	---	---	---	---	---	---
291200Z 19.8N 122.5E	35	19.4N 122.7E	35	18 0	---	---	---	---	---	---	---
291800Z 20.8N 122.0E	30	19.4N 122.1E	35	88 5	---	---	---	---	---	---	---
300000Z 21.6N 122.0E	25	19.7N 122.1E	30	122 5	---	---	---	---	---	---	---

TROPICAL STORM MUPE

0000Z 9 AUG TO 0600Z 12 AUG

BEST TRACK		WANNING		ERRORS		24 HOUR FORECAST		48 HOUR FORECAST		72 HOUR FORECAST	
POSIT	WIND	POSIT	WIND	US1 WIND	POSIT	WIND	US1 WIND	POSIT	WIND	POSIT	WIND
090000Z 26.1N 154.0E	30	26.4N 154.7E	30	19 0	30.0N 152.7E	40	122 -5	---	---	---	---
091200Z 26.8N 153.0E	30	27.2N 154.2E	30	47 0	30.7N 153.9E	40	78 0	---	---	---	---
091800Z 27.0N 152.0E	35	27.2N 152.7E	30	13 -5	30.8N 149.7E	40	159 0	---	---	---	---
100000Z 27.7N 152.0E	40	27.3N 152.0E	40	12 0	30.2N 150.0E	45	12 5	33.0N 149.0E	45	158 15	---
100600Z 28.3N 151.4E	45	28.0N 151.1E	45	28 0	31.0N 148.8E	50	19 15	35.4N 147.0E	40	204 10	---
101200Z 28.9N 150.9E	40	28.7N 150.3E	50	32 10	32.3N 148.2E	50	60 20	---	---	---	---
101800Z 29.6N 150.3E	40	29.8N 150.2E	50	13 10	33.7N 149.1E	50	147 20	---	---	---	---
110000Z 30.3N 149.9E	40	30.4N 149.9E	40	8 0	34.2N 149.5E	35	212 5	---	---	---	---
110600Z 30.8N 149.1E	35	31.2N 149.2E	40	24 5	34.6N 148.4E	35	206 5	---	---	---	---
111200Z 31.3N 148.3E	30	31.2N 148.5E	40	12 10	---	---	---	---	---	---	---
111800Z 31.7N 147.4E	30	32.5N 148.1E	40	59 10	---	---	---	---	---	---	---
120000Z 32.2N 146.0E	30	33.5N 148.0E	40	127 10	---	---	---	---	---	---	---
120600Z 32.9N 144.8E	30	32.3N 144.8E	40	36 10	---	---	---	---	---	---	---

TROPICAL DEPRESSION 11

0000Z 13 AUG TO 0000Z 14 AUG

BEST TRACK		WANNING		ERRORS		24 HOUR FORECAST		48 HOUR FORECAST		72 HOUR FORECAST	
POSIT	WIND	POSIT	WIND	US1 WIND	POSIT	WIND	US1 WIND	POSIT	WIND	POSIT	WIND
130000Z 30.0N 157.0E	30	30.0N 158.2E	30	31 0	31.4N 156.0E	45	148 20	---	---	---	---
130600Z 30.2N 156.0E	30	30.3N 157.0E	30	52 0	32.1N 156.0E	45	162 20	---	---	---	---
131200Z 30.3N 155.0E	30	30.2N 155.9E	30	8 0	---	---	---	---	---	---	---
131800Z 30.5N 154.0E	25	30.5N 154.4E	30	21 0	---	---	---	---	---	---	---
140000Z 30.8N 153.0E	25	30.7N 153.7E	30	8 5	---	---	---	---	---	---	---
140600Z 31.2N 153.0E	25	31.2N 152.6E	25	20 0	---	---	---	---	---	---	---

TROPICAL STORM JOAN

0000Z 18 AUG TO 1200Z 20 AUG

BEST TRACK		WANNING		ERRORS		24 HOUR FORECAST		48 HOUR FORECAST		72 HOUR FORECAST	
POSIT	WIND	POSIT	WIND	US1 WIND	POSIT	WIND	US1 WIND	POSIT	WIND	POSIT	WIND
180600Z 19.4N 129.3E	30	19.2N 129.3E	30	12 0	19.8N 126.0E	45	141 5	---	---	---	---
181200Z 19.8N 128.0E	30	18.8N 129.3E	30	95 0	18.7N 125.9E	45	224 0	---	---	---	---
181800Z 20.7N 126.0E	30	18.6N 128.4E	30	161 0	18.8N 124.9E	40	221 5	---	---	---	---
190000Z 21.4N 125.5E	35	18.3N 127.2E	30	208 -5	18.9N 123.4E	40	195 10	---	---	---	---
190600Z 21.7N 124.3E	40	22.2N 125.0E	30	41 -10	24.8N 120.6E	35	219 5	---	---	---	---
191200Z 21.7N 123.5E	45	22.0N 123.5E	40	18 -5	23.6N 118.4E	35	148 5	---	---	---	---
191800Z 21.5N 122.2E	35	22.0N 122.0E	45	32 10	---	---	---	---	---	---	---
200000Z 21.5N 121.3E	30	22.7N 120.8E	45	55 15	---	---	---	---	---	---	---
200600Z 21.3N 119.4E	30	21.0N 119.4E	30	18 0	---	---	---	---	---	---	---
201200Z 21.3N 117.4E	30	21.1N 117.5E	15	13 -15	---	---	---	---	---	---	---

TROPICAL STORM KATE

0000Z 24 AUG TO 0000Z 26 AUG

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND
240000Z	19.1N 111.7E	45	16.3N 111.7E	30	48 -10	17.8N 109.2E	40	149 -20	---	---	---	---	---	---	---	---	---	---	---
241200Z	19.4N 111.3E	50	16.8N 111.3E	30	48 -20	18.8N 108.8E	25	117 -35	---	---	---	---	---	---	---	---	---	---	---
241800Z	19.7N 110.8E	55	16.9N 110.9E	30	48 -20	19.2N 108.7E	25	136 -35	---	---	---	---	---	---	---	---	---	---	---
250000Z	20.0N 109.3E	55	19.9N 109.9E	40	23 -10	20.6N 107.1E	40	56 5	---	---	---	---	---	---	---	---	---	---	---
250600Z	20.2N 109.3E	60	20.2N 108.9E	60	22 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
251200Z	20.4N 107.0E	60	20.5N 108.2E	60	34 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
251800Z	20.6N 106.8E	60	20.7N 107.0E	60	13 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
260000Z	20.8N 106.1E	40	21.0N 106.1E	30	12 -0	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TROPICAL DEPRESSION 14

1200Z 1 SEP TO 0000Z 2 SEP

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND
011200Z	19.2N 100.6E	30	19.6N 107.5E	30	46 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
011800Z	19.2N 100.4E	30	19.4N 106.5E	30	13 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
020000Z	19.4N 105.9E	30	19.3N 105.9E	30	6 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
020600Z	19.7N 105.5E	25	19.7N 105.5E	30	0 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TROPICAL STORM SARAH

0000Z 10 NOV TO 1800Z 10 NOV

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND
100000Z	12.5N 111.0E	40	12.6N 111.5E	30	6 -10	---	---	---	---	---	---	---	---	---	---	---	---	---	---
100600Z	12.5N 110.5E	50	12.1N 110.4E	50	8 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
101200Z	12.4N 109.5E	55	12.2N 109.4E	55	13 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
101800Z	12.5N 108.5E	35	12.2N 108.8E	35	25 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TROPICAL STORM THELMA

0000Z 15 NOV TO 0600Z 16 NOV

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT		WIND		POSIT		WIND		ERRORS		ERRORS		ERRORS		ERRORS		ERRORS			
UST	WIND			UST	WIND			UST	WIND	UST	WIND	UST	WIND	UST	WIND	UST	WIND		
150000Z	10.0N	111.7E	40	10.4N	110.0E	40	103	0	10.4N	104.8E	35	192	0	10.4N	100.1E	55	297		
150600Z	10.0N	110.1E	30	9.9N	109.7E	55	24	0	9.6N	104.0E	50	159	20	9.9N	100.5E	65	230		
151200Z	9.9N	108.8E	55	9.6N	108.7E	55	8	0	9.6N	103.9E	50	148	25	---	---	---	---		
151800Z	9.8N	108.3E	55	9.7N	107.7E	55	36	10	9.6N	102.9E	55	165	30	---	---	---	---		
160000Z	9.8N	106.0E	35	9.6N	108.3E	30	21	-0	9.6N	108.3E	30	189	10	---	---	---	---		
160600Z	9.8N	107.3E	30	9.7N	107.3E	30	6	0	9.7N	106.0E	30	24	10	---	---	---	---		
161200Z	9.8N	105.9E	25	9.8N	106.3E	30	6	0	---	---	---	---	---	---	---	---	---		
161800Z	9.7N	105.7E	25	9.6N	105.4E	25	19	0	---	---	---	---	---	---	---	---	---		
170000Z	9.7N	105.1E	20	9.0N	104.3E	25	63	0	---	---	---	---	---	---	---	---	---		
170600Z	9.7N	104.4E	20	9.0N	105.3E	20	68	0	---	---	---	---	---	---	---	---	---		
180000Z	10.4N	101.4E	25	---	---	---	---	---	---	---	---	---	---	---	---	---	---		

TROPICAL STORM VERA

1200Z 19 NOV TO 0600Z 26 NOV

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND	POSIT	WIND	ERRORS UST WIND
191200Z	10.0N 126.5E	30	10.6N 126.9E	30	43 0	12.0N 123.9E	35	40 5	---	---	---	---	---	---	---	---	---	---	---
191800Z	11.3N 125.5E	30	11.7N 125.9E	30	33 0	13.5N 122.5E	35	130 5	---	---	---	---	---	---	---	---	---	---	---
200000Z	11.5N 124.0E	30	12.1N 125.1E	25	46 -0	13.5N 122.7E	25	126 -5	---	---	---	---	---	---	---	---	---	---	---
200600Z	11.4N 124.1E	30	11.8N 122.5E	30	80 0	12.7N 118.5E	40	230 10	---	---	---	---	---	---	---	---	---	---	---
201200Z	11.4N 123.0E	30	11.7N 123.3E	30	25 0	12.4N 119.7E	40	111 10	---	---	---	---	---	---	---	---	---	---	---
201800Z	11.4N 123.1E	30	11.5N 122.0E	30	65 0	11.6N 117.9E	40	158 10	---	---	---	---	---	---	---	---	---	---	---
210000Z	11.4N 122.0E	30	11.5N 121.0E	30	94 0	11.5N 116.9E	40	182 5	---	---	---	---	---	---	---	---	---	---	---
210600Z	11.4N 121.0E	30	11.5N 121.3E	30	41 0	11.5N 118.9E	30	38 0	---	---	---	---	---	---	---	---	---	---	---
211200Z	11.4N 121.3E	30	11.6N 122.5E	30	71 0	11.6N 121.4E	30	156 -10	---	---	---	---	---	---	---	---	---	---	---
211800Z	11.5N 120.0E	30	11.6N 121.6E	30	59 0	11.6N 120.4E	30	136 -10	---	---	---	---	---	---	---	---	---	---	---
220000Z	11.6N 120.0E	35	11.6N 120.3E	30	18 -0	11.6N 117.3E	40	81 -5	---	---	---	---	---	---	---	---	---	---	---
220600Z	11.9N 119.4E	35	11.6N 119.6E	30	21 -0	11.6N 116.9E	40	109 -5	---	---	---	---	---	---	---	---	---	---	---
221200Z	12.2N 118.0E	40	12.6N 119.4E	40	42 0	13.0N 117.0E	50	40 5	13.4N 114.0E	55	144 5	13.8N 111.4E	55	184 25	---	---	---	---	---
221800Z	12.6N 118.3E	40	12.6N 118.6E	40	31 0	13.2N 116.3E	50	95 0	---	---	---	---	---	---	---	---	---	---	---
230000Z	12.9N 117.7E	45	13.1N 117.3E	40	26 -0	13.8N 114.2E	50	80 0	14.1N 110.9E	45	154 0	14.4N 107.7E	20	304 -5	---	---	---	---	---
230600Z	13.2N 117.3E	45	13.4N 116.5E	40	48 -0	13.8N 113.9E	40	100 -10	14.1N 110.1E	35	191 0	---	---	---	---	---	---	---	---
231200Z	13.6N 116.7E	40	13.4N 116.4E	40	13 -10	13.8N 114.3E	40	120 -10	14.1N 111.0E	35	150 5	---	---	---	---	---	---	---	---
231800Z	14.1N 110.1E	50	13.8N 116.3E	40	21 -10	14.6N 113.8E	30	88 -10	14.8N 111.5E	35	128 10	---	---	---	---	---	---	---	---
240000Z	14.6N 115.3E	30	14.5N 115.4E	40	8 -0	15.6N 112.2E	50	43 10	15.7N 109.4E	45	174 20	---	---	---	---	---	---	---	---
240600Z	15.2N 114.5E	50	15.2N 114.2E	50	17 0	16.9N 110.4E	60	118 25	17.3N 107.2E	50	274 30	---	---	---	---	---	---	---	---
241200Z	15.7N 113.0E	30	15.6N 113.3E	50	18 0	16.9N 110.1E	60	116 30	---	---	---	---	---	---	---	---	---	---	---
241800Z	15.9N 113.1E	45	16.2N 113.3E	50	21 0	16.4N 110.4E	60	124 35	---	---	---	---	---	---	---	---	---	---	---
250000Z	16.2N 112.0E	45	16.8N 112.5E	50	36 10	16.8N 109.6E	40	162 15	---	---	---	---	---	---	---	---	---	---	---
250600Z	16.4N 112.4E	35	16.8N 111.7E	40	47 10	16.7N 108.1E	30	231 10	---	---	---	---	---	---	---	---	---	---	---
251200Z	16.6N 112.1E	30	17.3N 111.5E	40	54 10	---	---	---	---	---	---	---	---	---	---	---	---	---	---
251800Z	16.9N 111.9E	25	17.5N 110.6E	30	82 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
260000Z	17.2N 111.9E	25	17.2N 111.8E	30	6 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---
260600Z	17.6N 112.0E	20	17.4N 111.9E	20	13 0	---	---	---	---	---	---	---	---	---	---	---	---	---	---

6. TYPHOON DATA

TYPHOON ANITA

18004 5 JUL TO 18002 8 JUL

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND
051800Z	11.1N 112.4E	30	11.5N 112.0E	30	42	0	12.5N 109.7E	35	120	-25	---	---	---	---	---	---	---	---	---
060800Z	11.6N 112.4E	35	11.7N 111.4E	30	59	-5	12.8N 109.2E	30	150	-30	---	---	---	---	---	---	---	---	---
080800Z	12.8N 112.7E	55	12.3N 112.5E	50	21	-8	13.9N 110.8E	60	104	-5	15.7N 108.4E	55	186	-15	---	---	---	---	---
081500Z	12.8N 112.7E	55	12.3N 112.5E	50	19	-5	13.3N 110.4E	60	206	-5	14.5N 108.4E	55	297	-25	---	---	---	---	---
061800Z	13.4N 111.7E	60	13.3N 111.5E	55	13	-5	14.7N 109.7E	65	168	0	16.5N 107.8E	50	244	10	---	---	---	---	---
070000Z	14.5N 111.1E	60	14.3N 111.0E	60	13	0	16.8N 109.5E	70	129	5	---	---	---	---	---	---	---	---	---
070800Z	15.2N 110.4E	65	15.8N 110.1E	70	21	5	20.7N 108.5E	45	182	-25	---	---	---	---	---	---	---	---	---
071800Z	17.7N 108.8E	65	19.5N 108.8E	75	13	10	21.3N 108.8E	45	194	-25	---	---	---	---	---	---	---	---	---
080000Z	17.6N 107.4E	65	17.7N 107.7E	65	18	0	---	---	---	---	---	---	---	---	---	---	---	---	---
081500Z	18.7N 108.8E	78	18.5N 108.8E	65	17	-5	---	---	---	---	---	---	---	---	---	---	---	---	---
081800Z	19.1N 104.5E	40	19.2N 104.5E	50	6	10	---	---	---	---	---	---	---	---	---	---	---	---	---

TYPHOONS WHILE WIND OVER 35KTS				WARNING				ALL FORECASTS			
AVERAGE FORECAST ERROR	24-HR	48-HR	72-HR	24-HR	48-HR	72-HR	0NN	24-HR	48-HR	72-HR	0NN
AVERAGE RIGHT ANGLE ERROR	22NM	15NM	24NM	0NM	13NM	14NM	9NM	0KTS	14KTS	20KTS	0KTS
AVERAGE MAGNITUDE OF WIND ERROR	13KTS	10KTS	9KTS	0KTS	13KTS	14KTS	9KTS	0KTS	14KTS	20KTS	0KTS
AVERAGE BIAS OF WIND ERROR	13KTS	-11KTS	-13KTS	0KTS	13KTS	-11KTS	-13KTS	0KTS	13KTS	-11KTS	-13KTS
NUMBER OF FORECASTS	13	9	3	0	13	9	3	0	13	9	3

TYPHOON BILLIE

06004 13 JUL TO 18002 19 JUL

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST							
								ERRORS				ERRORS				ERRORS							
130400Z	16.7N	125.9E	40	16.8N	125.0E	45	52	5	19.9N	122.1E	70	193	0	22.6N	119.4E	80	337	-50	25.9N	117.3E	35	450	-80
131800Z	17.8N	125.4E	55	17.9N	125.7E	55	24	5	20.5N	123.3E	65	103	-30	21.8N	121.5E	80	220	-40	24.4N	119.5E	45	325	-75
140000Z	18.5N	125.3E	60	18.5N	125.1E	65	11	5	21.2N	124.2E	80	64	-35	24.1N	123.3E	90	104	-10	27.2N	122.6E	90	140	-25
140600Z	19.1N	125.5E	70	19.2N	125.2E	70	18	0	22.0N	124.9E	80	33	-50	24.8N	124.1E	90	97	-35	28.9N	123.3E	80	197	-20
141000Z	19.1N	125.4E	85	19.5N	125.4E	75	13	-10	21.8N	124.9E	90	37	-30	24.4N	123.0E	95	124	-25	27.3N	122.3E	85	195	-10
141800Z	20.3N	125.4E	100	20.2N	125.4E	80	6	-20	23.2N	124.9E	95	18	-10	26.0N	124.0E	95	83	-25	28.7N	123.6E	95	130	-5
150000Z	20.9N	125.7E	115	21.1N	125.3E	110	12	-5	24.0N	124.6E	135	33	35	26.7N	123.8E	130	97	15	29.5N	123.7E	115	134	30
151200Z	21.9N	125.3E	120	21.5N	125.2E	110	18	-10	25.1N	124.6E	135	57	-20	27.8N	123.9E	125	124	-15	30.9N	123.7E	110	163	25
151800Z	23.1N	125.7E	105	23.2N	125.0E	110	13	5	26.0N	123.7E	100	98	-20	28.5N	122.2E	80	184	-20	31.9N	121.6E	55	137	0
160000Z	23.9N	125.7E	100	23.8N	125.2E	100	6	0	26.6N	124.9E	95	62	-20	29.5N	124.2E	85	125	0	32.8N	123.3E	75	164	25
160600Z	24.6N	125.5E	115	24.8N	125.2E	105	16	-10	27.8N	124.7E	95	44	-15	30.8N	124.3E	85	114	10	---	---	---	---	---
161200Z	25.6N	125.7E	120	25.5N	125.7E	100	6	-20	28.8N	126.2E	90	39	-15	32.1N	126.0E	80	156	15	---	---	---	---	---
161800Z	26.6N	125.4E	120	26.8N	125.6E	100	16	-20	30.5N	125.2E	90	21	-10	33.7N	125.7E	80	165	25	---	---	---	---	---
170200Z	28.9N	123.3E	115	28.8N	125.5E	105	20	-5	31.3N	124.5E	90	31	-5	36.5N	123.9E	55	141	5	---	---	---	---	---
171200Z	29.0N	125.5E	105	29.2N	125.3E	95	20	-10	32.5N	125.0E	70	101	5	---	---	---	---	---	---	---	---	---	---
171800Z	30.2N	125.4E	100	30.2N	125.5E	90	5	-10	33.5N	125.5E	65	158	10	---	---	---	---	---	---	---	---	---	---
180200Z	31.7N	124.9E	95	31.9N	125.4E	80	20	-10	36.3N	126.2E	55	216	-5	---	---	---	---	---	---	---	---	---	---
181200Z	34.1N	122.3E	55	34.2N	122.9E	60	18	-5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
190000Z	35.1N	122.0E	50	34.9N	120.8E	50	60	0	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
WARNING				WARNING			
24-HR				24-HR			
70NM				70NM			
151NM				151NM			
210NM				210NM			
AVERAGE FORECAST ERROR				AVERAGE FORECAST ERROR			
17NM				17NM			
45NM				45NM			
123NM				123NM			
171NM				171NM			
31KTS				31KTS			
AVERAGE RIGHT ANGLE ERROR				AVERAGE RIGHT ANGLE ERROR			
17NM				17NM			
45NM				45NM			
123NM				123NM			
171NM				171NM			
31KTS				31KTS			
AVERAGE MAGNITUDE OF WIND ERROR				AVERAGE MAGNITUDE OF WIND ERROR			
17NM				17NM			
45NM				45NM			
123NM				123NM			
171NM				171NM			
31KTS				31KTS			
AVERAGE BIAS OF WIND ERROR				AVERAGE BIAS OF WIND ERROR			
-6KTS				-6KTS			
-10KTS				-10KTS			
-10KTS				-10KTS			
-16KTS				-16KTS			
NUMBER OF FORECASTS				NUMBER OF FORECASTS			
24				24			
20				20			
16				16			
12				12			

TYPHOON DOT

0600Z 14 JUL TO 0600Z 20 JUL

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
TIME	POSIT	WIND	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND
140000Z	17.2N	114.4E	35	17.3N	112.8E	30	103	19.3N	111.8E	45	120	20.1N	110.8E	55	267	21.7N	111.2E	45	245
141200Z	17.9N	114.9E	42	17.7N	114.9E	30	26	18.2N	112.7E	45	178	20.1N	110.8E	55	267	21.7N	111.2E	45	245
150000Z	17.6N	113.4E	45	17.5N	113.8E	40	13	18.2N	112.7E	50	82	20.1N	110.8E	55	267	21.7N	111.2E	45	245
150400Z	18.1N	113.4E	55	18.1N	113.4E	50	6	19.7N	112.5E	60	76	21.7N	111.2E	45	245				
151200Z	18.5N	113.4E	60	18.4N	113.5E	60	6	20.3N	112.6E	65	89								
151800Z	18.5N	113.4E	60	18.4N	113.5E	60	6	20.3N	112.6E	65	89								
160000Z	19.4N	113.4E	75	19.2N	113.3E	70	13	20.7N	112.5E	80	171								
160400Z	20.3N	113.7E	80	20.4N	113.5E	75	13	23.0N	113.3E	50	108								
161200Z	21.8N	114.0E	85	21.8N	114.2E	80	28												
161800Z	21.8N	114.0E	85	21.8N	114.2E	80	28												
170000Z	22.7N	114.7E	65	22.6N	114.4E	50	18												
170400Z	23.5N	115.7E	40	23.7N	115.1E	35	13												
180000Z	27.8N	129.7E	30	28.2N	127.9E	30	93	32.4N	129.3E	45	287								
180400Z	27.8N	129.7E	30	28.2N	127.9E	30	93	32.4N	129.3E	45	287								
191200Z	29.6N	127.3E	30	29.8N	127.0E	30	70												
191800Z	31.0N	127.2E	30	30.0N	127.0E	40	61												
200000Z	32.6N	126.6E	25	32.6N	127.1E	35	25												
200400Z	34.8N	126.1E	25	34.7N	126.2E	25	8												

TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
25NM	123NM	256NM	0NM	25NM	123NM	256NM	0NM
15NM	79NM	156NM	0NM	15NM	79NM	156NM	0NM
AVERAGE FORECAST ERROR				AVERAGE FORECAST ERROR			
25NM	123NM	256NM	0NM	25NM	123NM	256NM	0NM
15NM	79NM	156NM	0NM	15NM	79NM	156NM	0NM
AVERAGE MAGNITUDE OF WIND ERROR				AVERAGE MAGNITUDE OF WIND ERROR			
6KTS	18KTS	8KTS	0KTS	6KTS	18KTS	8KTS	0KTS
-6KTS	-6KTS	-3KTS	0KTS	-6KTS	-6KTS	-3KTS	0KTS
AVERAGE BIAS OF WIND ERROR				AVERAGE BIAS OF WIND ERROR			
19	11	2	0	19	11	2	0
NUMBER OF FORECASTS				NUMBER OF FORECASTS			

TYPHOON ELLEN

1800Z 17 JUL TO 0600Z 29 JUL

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
TIME	POSIT	WIND	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND
171800Z	21.7N	139.1E	50	21.1N	139.1E	30	18	22.2N	137.9E	40	178	29.2N	136.9E	80	70	32.3N	136.4E	80	8
180000Z	22.3N	138.4E	65	22.0N	138.8E	55	16	26.1N	137.7E	75	99	29.2N	136.9E	80	70	32.3N	136.4E	80	8
180400Z	22.5N	138.4E	72	22.7N	138.1E	95	25	25.7N	139.2E	75	113	28.4N	135.0E	75	189	31.4N	134.5E	75	103
180800Z	22.5N	138.4E	72	22.7N	138.1E	95	25	25.7N	139.2E	75	113	28.4N	135.0E	75	189	31.4N	134.5E	75	103
181200Z	23.5N	138.1E	85	23.0N	137.9E	70	32	24.3N	136.8E	80	248	26.0N	135.7E	75	356				
190000Z	24.5N	138.2E	100	24.4N	138.0E	100	32	27.8N	137.7E	110	105	31.4N	135.1E	100	157				
190400Z	25.7N	138.7E	105	26.0N	137.9E	100	28	30.3N	136.8E	95	52	34.7N	135.3E	65	157				
191200Z	26.9N	138.4E	90	26.7N	138.3E	95	13	30.4N	137.5E	90	52								
191800Z	28.2N	138.4E	80	28.3N	138.4E	95	6	32.4N	137.5E	90	50								
200000Z	29.5N	138.2E	65	29.3N	138.3E	75	13	33.5N	137.9E	60	105								
200400Z	30.7N	137.7E	55	30.7N	137.9E	60	17	36.8N	136.0E	35	287								
201200Z	31.6N	137.1E	55	31.7N	137.7E	45	11												
201800Z	31.9N	136.7E	50	32.4N	136.4E	45	33												
210000Z	32.2N	136.4E	50	32.6N	136.4E	40	24												
210400Z	32.2N	136.3E	45	32.0N	136.5E	20	16												
230000Z	30.8N	132.1E	30	30.9N	131.8E	30	12	32.8N	127.8E	35	143								
231200Z	30.3N	131.4E	30	30.4N	131.1E	30	5	30.9N	126.9E	35	135								
231800Z	30.1N	130.9E	30	30.1N	130.8E	30	5												
240000Z	30.2N	130.4E	30	30.2N	130.2E	30	2	30.2N	129.8E	25	121								
240400Z	30.2N	130.4E	30	30.2N	130.2E	30	2												
241200Z	30.9N	129.4E	30	30.8N	129.5E	30	8												
250000Z	31.7N	129.4E	25	32.0N	129.5E	25	19												
250400Z	32.2N	129.4E	20	32.3N	129.5E	25	21												
280000Z	32.5N	137.1E	45	32.6N	137.2E	40	8												
281200Z	33.3N	137.4E	35	33.4N	137.4E	40	5												
281800Z	34.1N	137.4E	25	34.0N	137.4E	40	8												
290000Z	34.6N	137.2E	25	34.8N	137.5E	30	19												

TYPHOONS WHILE WIND OVER 35KTS				ALL FORECASTS			
WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
17NM	135NM	201NM	55NM	17NM	135NM	201NM	55NM
13NM	90NM	116NM	53NM	13NM	90NM	116NM	53NM
6KTS	10KTS	25KTS	30KTS	6KTS	10KTS	25KTS	30KTS
AVERAGE FORECAST ERROR				AVERAGE FORECAST ERROR			
13NM	90NM	116NM	53NM	13NM	90NM	116NM	53NM
6KTS	10KTS	25KTS	30KTS	6KTS	10KTS	25KTS	30KTS
AVERAGE MAGNITUDE OF WIND ERROR				AVERAGE MAGNITUDE OF WIND ERROR			
2KTS	4KTS	25KTS	30KTS	2KTS	4KTS	25KTS	30KTS
AVERAGE BIAS OF WIND ERROR				AVERAGE BIAS OF WIND ERROR			
28	14	6	2	28	14	6	2
NUMBER OF FORECASTS				NUMBER OF FORECASTS			

TYPHOON GEORGIA

0600Z 09 AUG TO 1800Z 12 AUG

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND
091800Z	19.7N 118.9E	40	19.9N 118.9E	35	18	-5	19.6N 112.4E	60	25	-5	20.7N 109.5E	50	145	-30	22.8N 106.3E	25	279	-25	
091800Z	19.5N 114.4E	55	19.5N 114.9E	60	6	5	19.7N 111.3E	55	62	-15	21.0N 107.7E	35	219	-30					
100000Z	19.5N 114.4E	60	19.3N 113.8E	60	16	0	19.1N 110.2E	55	96	-15	19.8N 104.1E	40	289	-20					
101800Z	18.3N 112.4E	95	18.3N 112.4E	85	31	-5	18.7N 108.9E	40	188	-35	20.6N 106.3E	20	398	-10					
101800Z	19.1N 112.7E	70	18.9N 111.9E	65	21	-5	18.9N 108.1E	40	197	-25	20.3N 104.5E	25	369	-5					
110200Z	18.3N 111.4E	70	18.1N 111.3E	65	23	-5	18.5N 108.4E	35	191	-25									
111800Z	20.6N 111.2E	65	19.1N 111.4E	65	37	0	21.9N 110.2E	40	186	18									
120200Z	21.7N 111.7E	68	21.9N 111.7E	65	17	15													
121800Z	22.5N 110.7E	35	22.5N 110.7E	45	18	10													

TYPHOONS WHILE WIND OVER 35KTS

	WARNING				24-HR				48-HR				72-HR			
	17NM	14NM	25NM	27NM	12NM	96NM	225NM	243NM	5KTS	15KTS	17KTS	25KTS	5KTS	15KTS	17KTS	25KTS
AVERAGE FORECAST ERROR																
AVERAGE RIGHT ANGLE ERROR																
AVERAGE MAGNITUDE OF WIND ERROR																
AVERAGE BIAS OF WIND ERROR																
NUMBER OF FORECASTS	15	11	7	1												

ALL FORECASTS

	WARNING				24-HR				48-HR				72-HR			
	17NM	14NM	25NM	27NM	12NM	96NM	225NM	243NM	5KTS	15KTS	17KTS	25KTS	5KTS	15KTS	17KTS	25KTS
AVERAGE FORECAST ERROR																
AVERAGE RIGHT ANGLE ERROR																
AVERAGE MAGNITUDE OF WIND ERROR																
AVERAGE BIAS OF WIND ERROR																
NUMBER OF FORECASTS	15	11	7	1												

TYPHOON IRIS

0600Z 10 AUG TO 1200Z 17 AUG

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT		WIND		POSIT		WIND		POSIT		WIND		POSIT		WIND		POSIT		WIND	
D S		ERROR	WIND	D S		ERROR	WIND	D S		ERROR	WIND	D S		ERROR	WIND	D S		ERROR	WIND
100600Z	21.3N 130.9E	35		21.0N 130.8E	30	19	-5	25.3N 130.1E	50	126	-5	--	--	--	--	27.8N 123.3E	80	545	-5
101200Z	22.2N 131.0E	40		21.8N 130.8E	40	26	0	--	--	--	--	26.1N 127.2E	80	285	5	29.6N 121.3E	85	678	0
101800Z	22.8N 131.1E	45		23.0N 131.0E	50	13	5	26.2N 129.3E	70	202	10	28.3N 125.5E	85	448	10	--	--	--	--
111000Z	23.2N 130.4E	55		23.4N 130.7E	50	13	-5	26.1N 128.9E	75	207	10	28.3N 125.8E	85	436	5	29.6N 122.0E	85	613	5
111600Z	23.4N 131.1E	55		23.9N 130.6E	50	36	-5	26.5N 128.7E	75	238	-5	28.1N 125.8E	80	472	-5	31.3N 122.7E	75	509	0
111600Z	23.1N 130.4E	60		23.2N 130.8E	50	6	-10	26.5N 130.1E	70	238	-5	28.1N 127.8E	80	472	-5	31.3N 122.7E	75	509	15
120400Z	23.1N 130.4E	95		23.5N 131.1E	55	32	-10	23.9N 131.3E	75	168	-5	24.7N 128.1E	80	287	0	28.8N 124.5E	80	295	10
121200Z	23.7N 131.4E	75		23.9N 131.3E	70	12	-5	23.8N 130.8E	80	115	5	28.8N 127.3E	85	187	35	28.8N 124.5E	180	284	25
130000Z	23.3N 131.7E	80		23.4N 131.6E	75	8	-5	24.9N 130.6E	90	87	10	26.7N 129.0E	95	86	25	29.4N 127.2E	95	78	25
130600Z	23.4N 132.0E	85		23.2N 131.6E	85	25	0	24.6N 130.9E	105	64	30	26.7N 129.2E	110	127	35	29.3N 127.4E	100	138	35
131200Z	23.6N 132.2E	85		23.5N 132.2E	85	20	0	25.1N 132.4E	95	96	25	27.4N 131.8E	85	218	20	31.3N 130.9E	85	257	35
131200Z	23.6N 132.2E	85		23.5N 132.2E	85	20	0	25.0N 132.2E	90	128	25	28.6N 131.8E	85	265	10	31.3N 130.9E	85	257	35
140000Z	24.8N 132.2E	80		24.8N 132.2E	85	0	5	27.4N 131.8E	90	134	20	30.2N 131.2E	80	263	10	33.3N 130.2E	45	265	0
141500Z	25.2N 131.7E	75		25.2N 131.7E	85	32	10	28.8N 131.3E	70	180	-5	30.9N 131.7E	85	387	0	32.2N 131.3E	35	308	18
141800Z	27.3N 130.3E	65		27.6N 130.6E	80	24	15	22.4N 130.2E	60	229	-15	36.7N 131.5E	40	367	-10	--	--	--	10
150000Z	28.1N 129.4E	70		28.4N 129.9E	70	32	0	23.2N 128.0E	65	198	-15	38.5N 130.6E	35	313	-10	--	--	--	15
151500Z	28.9N 129.7E	75		28.2N 128.8E	65	29	10	31.9N 125.8E	38	59	-15	37.1N 124.2E	48	238	5	--	--	--	20
151800Z	29.8N 126.9E	75		29.7N 127.2E	65	17	-10	22.5N 124.1E	85	91	5	--	--	--	--	--	--	--	22
160000Z	30.3N 126.1E	70		30.2N 126.1E	60	6	-10	23.6N 123.0E	45	156	0	--	--	--	--	--	--	--	25
161500Z	32.0N 125.9E	65		31.9N 125.4E	55	18	-15	25.2N 122.6E	48	172	10	--	--	--	--	--	--	--	25
161800Z	33.9N 124.4E	50		33.3N 125.5E	55	50	5	--	--	--	--	--	--	--	--	--	--	--	
170000Z	35.3N 125.4E	45		35.0N 126.1E	55	39	10	--	--	--	--	--	--	--	--	--	--	--	
170500Z	37.3N 124.2E	35		36.2N 128.8E	35	31	15	--	--	--	--	--	--	--	--	--	--	--	

TYPHOONS WHILE WIND OVER 35KTS

	WARNING				24-HR				48-HR				72-HR			
	16NM	14NM	26NM	32NM	10NM	97NM	153NM	157NM	7KTS	10KTS	11KTS	14KTS	7KTS	10KTS	11KTS	14KTS
AVERAGE FORECAST ERROR																
AVERAGE RIGHT ANGLE ERROR																
AVERAGE MAGNITUDE OF WIND ERROR																
AVERAGE BIAS OF WIND ERROR																
NUMBER OF FORECASTS	29	25	21	17												

ALL FORECASTS

	WARNING				24-HR				48-HR				72-HR			
	16NM	14NM	26NM	32NM	10NM	97NM	153NM	157NM	7KTS	10KTS	11KTS	14KTS	7KTS	10KTS	11KTS	14KTS
AVERAGE FORECAST ERROR																
AVERAGE RIGHT ANGLE ERROR																
AVERAGE MAGNITUDE OF WIND ERROR																
AVERAGE BIAS OF WIND ERROR																
NUMBER OF FORECASTS	29	25	21	17												

TYPHOON LULU

00004 3 SEP TO 0000Z 7 SEP

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND
030000Z	18.2N 120.7E	58	18.2N 120.9E	55	25	-5	21.2N 118.3E	75	176	38	20.2N 117.8E	35	363	35	---	---	---	---	---
031200Z	18.0N 119.2E	40	18.2N 119.9E	55	79	15	18.0N 117.8E	75	292	25	20.2N 115.9E	35	130	45	23.4N 114.7E	35	334	-25	5
040000Z	19.1N 119.4E	45	19.1N 119.0E	50	23	5	19.6N 116.6E	60	29	-5	20.6N 114.0E	65	102	-5	22.4N 112.1E	35	234	-25	5
040000Z	19.3N 118.7E	50	19.4N 118.6E	45	8	-5	20.2N 116.4E	60	81	-10	21.5N 113.9E	65	157	0	23.4N 111.8E	30	316	-20	6
041200Z	19.5N 118.1E	50	19.8N 118.2E	50	19	0	21.5N 116.3E	65	159	-10	23.4N 114.2E	45	265	115	---	---	---	---	7
041800Z	19.7N 117.2E	55	19.9N 117.2E	50	12	-5	21.1N 114.2E	70	188	-5	22.6N 111.7E	45	167	115	---	---	---	---	6
050000Z	19.9N 116.2E	65	19.9N 116.1E	60	30	-5	22.5N 112.6E	40	150	-30	21.8N 108.1E	45	90	-5	---	---	---	---	9
050000Z	19.9N 116.2E	70	19.9N 116.1E	70	30	0	22.4N 112.2E	85	153	20	---	---	---	---	---	---	---	---	10
051200Z	19.8N 113.4E	75	19.9N 113.2E	80	8	5	20.2N 109.9E	95	45	15	---	---	---	---	---	---	---	---	12
060000Z	20.3N 112.4E	70	20.3N 112.4E	70	8	10	21.7N 109.3E	50	164	-10	---	---	---	---	---	---	---	---	13
061200Z	20.7N 109.4E	60	20.9N 109.8E	60	30	0	---	---	---	---	---	---	---	---	---	---	---	---	14
070000Z	20.9N 108.2E	60	21.2N 108.1E	55	11	-5	---	---	---	---	---	---	---	---	---	---	---	---	---
070000Z	20.8N 108.2E	50	21.2N 108.1E	55	26	-5	---	---	---	---	---	---	---	---	---	---	---	---	---

	TYPHOONS WHILE WIND OVER 35KTS				WARNING ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	21NM	104NM	225NM	254NM	21NM	104NM	225NM	254NM
AVERAGE RIGHT ANGLE ERROR	14NM	71NM	180NM	173NM	14NM	71NM	180NM	173NM
AVERAGE MAGNITUDE OF WIND ERROR	6KTS	16KTS	17KTS	23KTS	6KTS	16KTS	17KTS	23KTS
AVERAGE BIAS OF WIND ERROR	3KTS	6KTS	-17KTS	-23KTS	3KTS	6KTS	-17KTS	-23KTS
NUMBER OF FORECASTS	18	14	9	3	18	14	9	3

TYPHOON MARGE

00004 12 SEP TO 1800Z 14 SEP

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND
120000Z	17.7N 118.4E	30	17.9N 118.3E	35	29	-5	17.2N 114.3E	45	87	-15	19.8N 111.6E	65	159	25	---	---	---	---	1
121200Z	18.2N 113.4E	45	18.3N 113.0E	55	8	5	20.2N 112.9E	70	178	-10	22.2N 109.2E	45	302	-25	---	---	---	---	2
130000Z	18.6N 114.7E	60	18.8N 114.7E	60	12	0	20.8N 110.8E	70	111	10	---	---	---	---	---	---	---	---	5
131200Z	18.8N 112.4E	75	18.9N 112.4E	85	8	-10	20.2N 108.4E	50	97	10	---	---	---	---	---	---	---	---	6
131800Z	19.0N 111.0E	80	19.0N 111.1E	85	6	5	19.9N 106.8E	60	31	5	---	---	---	---	---	---	---	---	7
140000Z	19.2N 109.4E	60	19.4N 109.5E	65	21	5	---	---	---	---	---	---	---	---	---	---	---	---	---
140600Z	19.4N 108.4E	40	19.3N 108.2E	55	34	15	---	---	---	---	---	---	---	---	---	---	---	---	---
141200Z	19.5N 107.4E	50	19.6N 107.0E	55	45	5	---	---	---	---	---	---	---	---	---	---	---	---	---
141800Z	19.7N 106.3E	55	20.0N 105.8E	55	33	0	---	---	---	---	---	---	---	---	---	---	---	---	---

	TYPHOONS WHILE WIND OVER 35KTS				WARNING ALL FORECASTS			
	WARNING	24-HR	48-HR	72-HR	WARNING	24-HR	48-HR	72-HR
AVERAGE FORECAST ERROR	18NM	77NM	224NM	0NM	18NM	77NM	224NM	0NM
AVERAGE RIGHT ANGLE ERROR	10NM	67NM	166NM	0NM	10NM	67NM	166NM	0NM
AVERAGE MAGNITUDE OF WIND ERROR	5KTS	11KTS	22KTS	0KTS	5KTS	11KTS	22KTS	0KTS
AVERAGE BIAS OF WIND ERROR	2KTS	-3KTS	-5KTS	0KTS	2KTS	-3KTS	-5KTS	0KTS
NUMBER OF FORECASTS	12	8	3	0	12	8	3	0

TYPHOON NURA
0000Z 2 OCT TO 0600Z 10 OCT

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
TIME	POSIT	WIND		POSIT	WIND			POSIT	WIND			POSIT	WIND			POSIT	WIND		
020000Z	11.4N 135.3E	30		11.4N 135.3E	30			12.4N 132.7E	50			11.3N 131.5E	50			11.3N 131.5E	50		
020600Z	11.4N 134.4E	30		11.7N 134.7E	30			13.1N 131.5E	50			13.1N 131.5E	50			13.1N 131.5E	50		
021200Z	11.4N 133.7E	40		11.5N 133.8E	45			12.6N 129.8E	70			12.7N 124.7E	65			12.7N 124.7E	65		
030000Z	11.0N 133.4E	50		11.3N 133.5E	50			11.3N 131.5E	70			11.3N 127.0E	65			11.8N 124.2E	65		
030600Z	11.0N 133.4E	50		11.3N 133.5E	50			11.3N 131.5E	70			11.3N 127.0E	65			11.8N 124.2E	65		
031200Z	11.0N 133.4E	50		11.3N 133.5E	50			11.3N 131.5E	70			11.3N 127.0E	65			11.8N 124.2E	65		
040000Z	11.4N 131.7E	70		11.1N 131.2E	75			11.4N 127.4E	100			11.6N 124.2E	70			12.7N 116.0E	60		
040600Z	11.0N 131.9E	70		11.2N 131.5E	75			11.7N 129.9E	100			13.0N 124.5E	110			13.8N 122.2E	70		
041200Z	13.0N 131.7E	80		12.8N 131.1E	80			13.6N 128.9E	95			13.5N 124.4E	110			13.9N 120.9E	65		
050000Z	13.4N 130.7E	90		13.4N 130.6E	80			13.5N 127.6E	100			13.6N 123.9E	90			14.4N 116.9E	65		
050600Z	13.0N 130.1E	110		13.2N 129.9E	105			13.6N 126.3E	125			14.7N 127.4E	120			15.4N 116.1E	75		
051200Z	14.2N 129.4E	125		14.2N 129.7E	130			15.5N 127.7E	125			16.6N 124.7E	115			17.8N 121.1E	60		
051800Z	14.5N 128.6E	145		14.6N 128.7E	145			16.3N 125.8E	120			17.4N 122.7E	115			18.6N 119.6E	65		
060000Z	14.7N 127.7E	160		14.8N 127.9E	150			15.8N 124.3E	145			16.6N 120.3E	90			17.7N 116.2E	90		
060600Z	14.8N 126.5E	150		14.8N 127.2E	155			15.2N 123.5E	140			16.2N 119.3E	90			16.8N 114.1E	60		
061200Z	14.8N 125.4E	140		14.9N 125.7E	145			15.3N 120.2E	90			15.6N 116.4E	90			16.3N 113.3E	55		
070000Z	15.6N 124.2E	120		15.7N 124.2E	140			17.4N 121.4E	110			19.5N 118.7E	80			22.5N 116.5E	50		
070600Z	16.3N 123.4E	115		16.1N 123.4E	135			17.8N 120.8E	70			20.1N 118.1E	80			23.0N 116.0E	85		
071200Z	17.1N 123.0E	110		17.2N 123.0E	125			21.0N 121.9E	100			25.0N 123.4E	85			27.5N 120.9E	55		
071800Z	18.0N 122.0E	100		18.1N 122.6E	125			21.9N 121.9E	100			25.9N 123.4E	85			27.5N 120.9E	55		
080000Z	18.8N 121.7E	90		18.7N 121.8E	95			21.1N 120.0E	80			23.3N 118.6E	70			24.5N 116.0E	55		
080600Z	18.5N 120.2E	80		18.5N 120.3E	95			21.5N 117.2E	90			23.6N 114.4E	35			24.5N 116.0E	55		
081200Z	20.4N 120.2E	75		20.8N 120.0E	65			23.0N 117.4E	45			25.0N 123.4E	85			27.5N 120.9E	55		
090000Z	20.8N 119.7E	70		20.8N 119.8E	70			21.9N 118.8E	75			23.3N 118.6E	70			24.5N 116.0E	55		
090600Z	21.4N 118.3E	70		21.5N 118.3E	75			22.7N 118.0E	65			25.0N 123.4E	85			27.5N 120.9E	55		
091200Z	22.9N 119.0E	65		23.0N 119.1E	75			23.0N 119.1E	75			23.0N 119.1E	75			23.0N 119.1E	75		
100000Z	24.0N 118.4E	65		23.8N 118.7E	70			24.0N 118.4E	65			24.0N 118.4E	65			24.0N 118.4E	65		
100600Z	25.2N 117.7E	40		25.3N 117.7E	50			25.3N 117.7E	50			25.3N 117.7E	50			25.3N 117.7E	50		

TYPHOONS WHILE WIND OVER 35KTS			
WARNING	24-HR	48-HR	72-HR
17NM	104NM	192NM	267NM
10NM	77NM	156NM	218NM
7KTS	1KTS	20KTS	38KTS
AVERAGE FORECAST ERROR	34	-1KTS	-9KTS
AVERAGE RIGHT ANGLE ERROR	30	4	20
AVERAGE MAGNITUDE OF WIND ERROR			
AVERAGE BIAS OF WIND ERROR			
NUMBER OF FORECASTS			

ALL FORECASTS			
WARNING	24-HR	48-HR	72-HR
17NM	104NM	192NM	267NM
10NM	77NM	156NM	218NM
7KTS	1KTS	20KTS	38KTS
AVERAGE FORECAST ERROR	34	-1KTS	-9KTS
AVERAGE RIGHT ANGLE ERROR	30	4	20
AVERAGE MAGNITUDE OF WIND ERROR			
AVERAGE BIAS OF WIND ERROR			
NUMBER OF FORECASTS			

TYPHOON OPAL
1200Z 4 OCT TO 0600Z 8 OCT

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
POSIT	WIND	POSIT	WIND	ERRORS	WIND	POSIT	WIND	ERRORS	WIND	POSIT	WIND	ERRORS	WIND	POSIT	WIND	ERRORS	WIND		
041200Z	11:5N 113:2E	20	11:3N 113:6E	30	28	-10	12:5N 110:6E	50	87	-10	14:2N 108:5E	35	232	-35	16:2N 107:1E	35	291	-40	
050000Z	12:2N 113:1E	40	12:7N 113:1E	45	18	0	14:5N 110:4E	65	117	-10	16:2N 107:1E	35	291	-40	18:2N 105:7E	35	291	-40	
050600Z	12:2N 113:1E	40	12:7N 113:1E	45	18	0	14:5N 110:4E	65	117	-10	16:2N 107:1E	35	291	-40	18:2N 105:7E	35	291	-40	
051200Z	12:8N 112:7E	60	13:1N 112:3E	60	13	-5	14:2N 110:7E	70	138	0	16:4N 108:0E	30	181	-20	18:2N 105:7E	35	291	-40	
060000Z	13:2N 111:9E	70	13:1N 112:0E	70	8	0	15:5N 111:3E	85	48	10	17:4N 108:9E	65	18	20	19:2N 107:1E	35	291	-40	
060600Z	13:2N 112:4E	75	13:6N 111:8E	75	37	0	15:1N 110:9E	90	49	15	17:4N 108:9E	65	18	20	19:2N 107:1E	35	291	-40	
061200Z	13:6N 113:0E	75	13:9N 111:7E	75	76	5	15:3N 110:7E	90	60	20	17:4N 108:9E	65	18	20	19:2N 107:1E	35	291	-40	
061800Z	14:0N 112:5E	75	14:1N 112:7E	75	13	5	15:3N 111:7E	80	125	20	17:4N 108:9E	65	18	20	19:2N 107:1E	35	291	-40	
070000Z	14:2N 111:7E	75	14:3N 112:4E	75	41	0	15:8N 110:4E	80	125	30	17:4N 108:9E	65	18	20	19:2N 107:1E	35	291	-40	
070600Z	14:3N 111:1E	75	14:2N 110:7E	75	24	0	15:8N 110:4E	80	125	30	17:4N 108:9E	65	18	20	19:2N 107:1E	35	291	-40	
071200Z	14:3N 110:4E	70	14:2N 110:7E	75	8	5	15:8N 110:4E	80	125	30	17:4N 108:9E	65	18	20	19:2N 107:1E	35	291	-40	
080000Z	14:3N 108:9E	45	14:2N 109:4E	65	30	20	15:8N 110:4E	80	125	30	17:4N 108:9E	65	18	20	19:2N 107:1E	35	291	-40	

TYPHOONS WHILE WIND OVER 35KTS			
WARNING	24-HR	48-HR	72-HR
12NM	62NM	89NM	0NM
5KTS	12KTS	27KTS	0KTS
1KTS	6KTS	-1KTS	0KTS
AVERAGE FORECAST ERROR	15	11	5
AVERAGE RIGHT ANGLE ERROR			
AVERAGE MAGNITUDE OF WIND ERROR			
AVERAGE BIAS OF WIND ERROR			
NUMBER OF FORECASTS			

ALL FORECASTS			
WARNING	24-HR	48-HR	72-HR
12NM	62NM	89NM	0NM
5KTS	12KTS	27KTS	0KTS
1KTS	6KTS	-1KTS	0KTS
AVERAGE FORECAST ERROR	15	11	5
AVERAGE RIGHT ANGLE ERROR			
AVERAGE MAGNITUDE OF WIND ERROR			
AVERAGE BIAS OF WIND ERROR			
NUMBER OF FORECASTS			

0600Z 4 OCT TO 0600Z 15 OCT

TYPHOONS WHILE WIND OVER 35KTS

ALL FORECASTS

WARNING	24-HR	48-HR	72-HR
21MM	85NM	212NM	318NM
14MM	37NM	122NM	170NM
8KTS	71KTS	36KTS	42KTS
29	22	21	17

12004 11 OCT TO 1200Z 19 OCT

TYPHOONS WHILE WIND OVER 35KTS

ALL FORECASTS

WARNING	24-HR	48-HR	72-HR
19MM	84MM	126MM	163MM
12MM	51MM	78MM	90MM
7KTS	13KTS	16KTS	19KTS
3KTS	2KTS	3KTS	0KTS
33	29	24	21

ANNEX A

SUMMARY OF TROPICAL CYCLONES IN THE CENTRAL NORTH PACIFIC

1. GENERAL RESUME

Fleet Weather Central, Pearl Harbor, issued warnings on two tropical cyclones in 1973 for the Central Pacific as shown in Table A-1. Warnings were coordinated with the Central Pacific Hurricane Center, Honolulu, and the Eastern Pacific Hurricane Center, San Francisco, in accordance with the National Hurricane Operations Plan.

TABLE A-1. COMPARISON OF CENTRAL PACIFIC ANNUAL WARNING AND CLIMATOLOGY DATA

	1969	1970	1971	1972	1973
TOTAL NUMBER OF WARNINGS	0	27	19	76	43
CALENDAR DAYS OF WARNING	0	8	8	21	13
TROPICAL DEPRESSIONS	0	1	1	0	1
TROPICAL STORMS	0	1	1	3	0
HURRICANES	0	1	1	1	1
TOTAL	0	3	3	4	2

2. INDIVIDUAL CASES ¹

Two tropical cyclones entered the Central Pacific from the east during 1973. Both Doreen and Katherine were fully developed hurricanes in the Eastern North Pacific before crossing 140°W longitude. Only Doreen was still of hurricane intensity upon entering the Central North Pacific.

Doreen, the first hurricane of the year to invade the Central North Pacific, was first located on 16 July by weather satellite near 10°N 101°W over the warm waters off Panama. Throughout her life cycle, Doreen followed a path strikingly similar to that of Hurricane Celeste of August 1972.

The small storm rapidly intensified to hurricane strength as she moved west-northwestward toward Hawaii. On the ninth day after detection, about 800 miles southeast of Hawaii, Doreen weakened to a tropical storm, turned to the southwest, and decelerated.

On the afternoon of the 27th, the 144-foot Greek ship, CORNELIA, sailed into the storm's path and sent out an emergency call for help when it lost its rudder while being lashed by 50 kt winds and 35-foot waves. A sea level pressure of 971mb was

reported. The ship managed to clear the storm and continued to Panama after deciding not to return to Honolulu with Coast Guard assistance.

After the slowdown, Doreen accelerated toward the west-northwest attaining 85kt winds near her center. She passed 300 miles south-southwest of South Point, Hawaii on the afternoon of the 30th.

On the afternoon of the 29th, nine-foot ocean swells and three and a half foot surf generated by Doreen were observed at Kapoho, the easternmost town on the island of Hawaii.

On the afternoon of 1 August, a weak Doreen passed 100 miles north of Johnston Island. Doreen dissipated under an upper trough two days later as she crossed the International Date Line. No damage was incurred at Hawaii or Johnston Island.

Beginning as a weak cloud circulation seen by weather satellite on 28 September, Katherine, the second and last Central North Pacific storm of 1973, developed over the warm waters off Panama in the same area as Doreen. However, Katherine did not follow the same path. She moved towards the northwest, intensifying to hurricane strength on 1 October, but then curved to the southwest between 120 and 125°E longitude.

Weakening to tropical storm strength, Katherine turned to the southwest on the 3rd. By the 6th, she began to follow a more westerly course near 13°N 130°W, dissipating a few days later 600 miles east-southeast of the island of Hawaii under a cold upper trough.

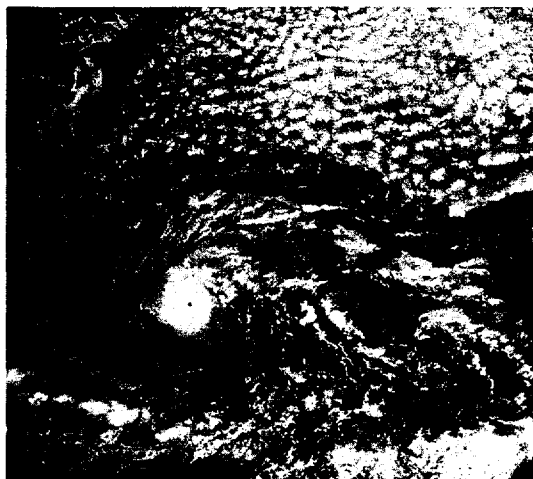
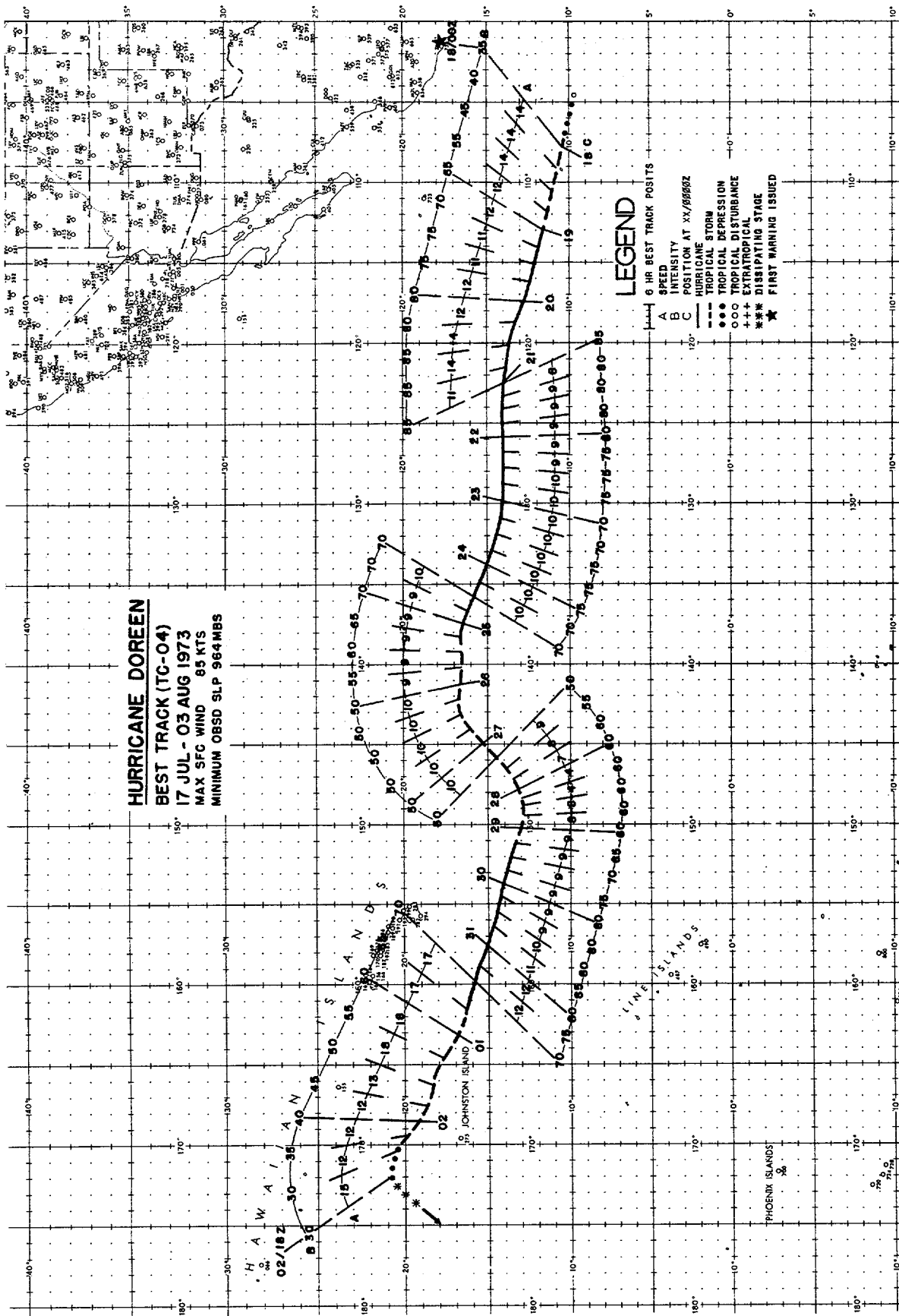
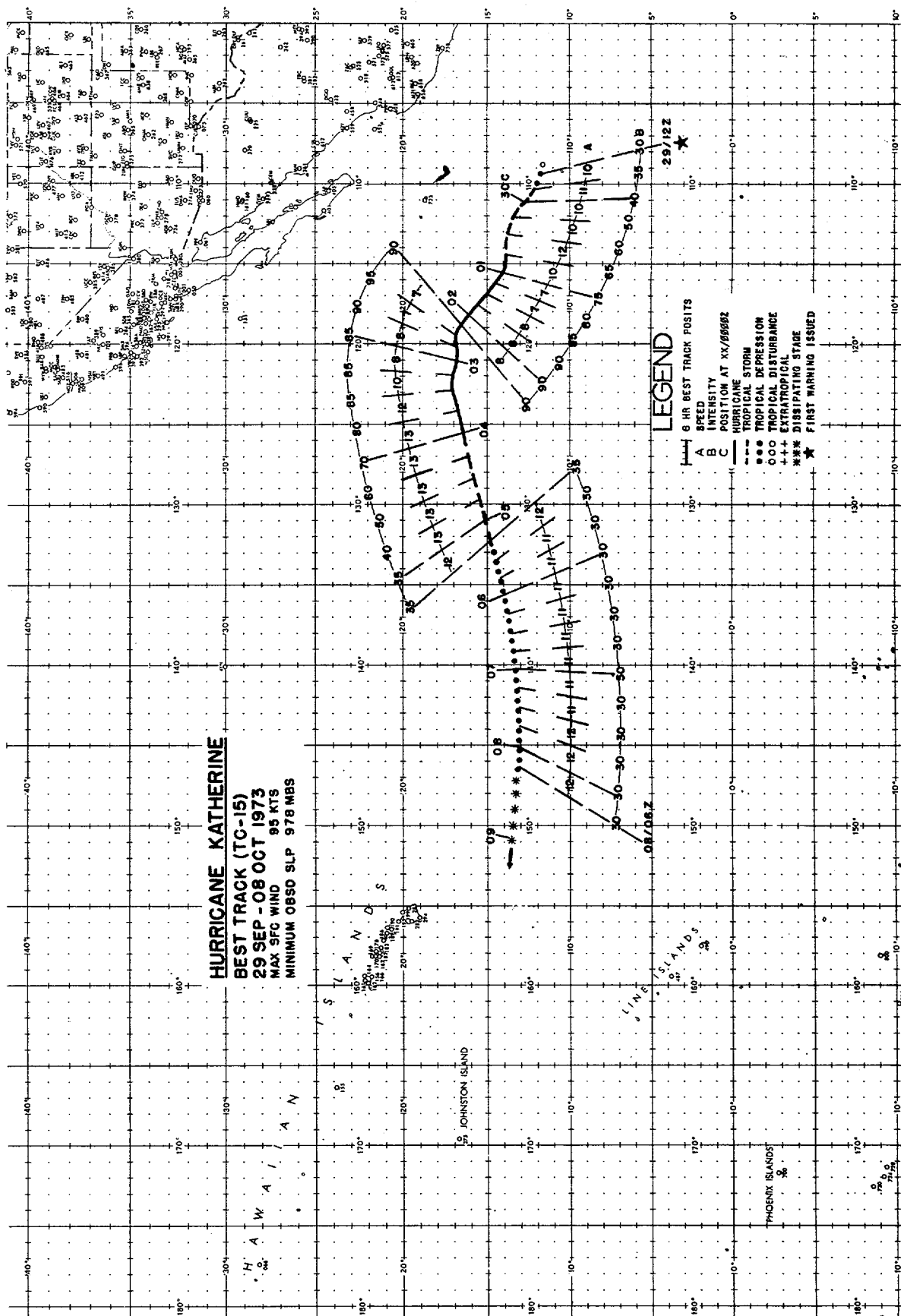


FIGURE A-1. Tropical Storm Doreen, 28 July 1973, 2149 GMT. (DMSP imagery)

¹Report submitted by Meteorologist in Charge, NWS Forecast Office, Honolulu, Hawaii.

3. HURRICANE TRACKS





4. CENTER FIX DATA - HURRICANES

HURRICANE DOREEN FIX POSITIONS FOR CYCLONE NO. 4 0600Z 18 JUL TO 0000Z 03 AUG

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVL	FLT DIR	MAX OBS VEL	MAX OBS WIND HRG	MAX OBS SFC WIND VEL	MAX OBS WIND HRG	OBS MIN SLP	MIN 700MB HGT	FLT LVL	EYE FORM	ORLEN- TATION	EYE DIA	POSIT OF RADAR	MSW NMBR	
1	171059Z	10.4N 125.0E	SAT						NUN	DAPP									
2	181059Z	11.2N 111.5E	SAT						NUN	DAPP									
3	181059Z	12.6N 116.5E	SAT						NUN	DAPP									
4	201137Z	14.1N 121.5E	P	10 5	700	90 102	340	70	120	300	30	972	285	15	8	CIRC	20	1	
5	201147Z	14.0N 122.2E	SAT						NUN	DAPP									
6	202024Z	14.3N 121.0E	P	15 5	700	10 95	330	10	60	330	45	968	283	17	7	CIRC	23	2	
7	211047Z	14.0N 125.5E	SAT						NUN	DAPP									
8	211906Z	14.1N 125.2E	P	5 5	700	50 90	310	18	80	310	818	968	281	10	9	ELIP	SE-NW 15x.5	3	
9	221141Z	14.4N 129.6E	SAT						NUN	DAPP									
10	231007Z	14.4N 131.8E	SAT						PCN 1	DAPP									
11	231036Z	14.4N 133.8E	SAT			(14.5/4.5 /D0.5/25HRS)			NUN	DAPP									
12	241737Z	15.7N 135.5E	SAT						NUN	DAPP									
13	241737Z	15.7N 135.5E	SAT						NUN	DAPP									
14	242106Z	15.4N 137.0E	SAT			(14.5/4.5 / / HRS)			PCN 1	DAPP									
15	250930Z	16.7N 138.9E	SAT						PCN 1	DAPP									
16	251030Z	16.4N 140.2E	SAT			(13.5/4.5 /W1.0/25HRS)			NUN	DAPP									
17	251030Z	16.4N 140.2E	SAT			(13.5/4.5 /W1.0/25HRS)			NUN	DAPP									
18	260923Z	16.4N 143.2E	SAT						PCN 1	DAPP									
19	261927Z	15.4N 144.6E	SAT			(11.5/2.5 /S /25HRS)			NUN	DAPP									
20	262218Z	15.4N 144.8E	SAT			(12.5/2.5 /S1.0/24HRS)			PCN 1	DAPP									
21	271051Z	14.2N 146.2E	SAT						PCN 1	DAPP									
22	271027Z	13.4N 147.3E	SAT			(14.0/4.0-/D0.5/23HRS)			NUN	DAPP									
23	281724Z	13.0N 149.4E	SAT			(14.0/4.0-/S /25HRS)			NUN	DAPP									
24	281730Z	13.0N 149.4E	P	5	200	40	350	20	12	80	50	8	967	280	10	10	CIRC	12	4
25	291024Z	13.7N 152.4E	SAT			(14.0/4.0-/S /25HRS)			NUN	DAPP									
26	301030Z	14.4N 156.4E	P	10	200	40	350	20	12	80	50	3	962	278	20	11	CIRC	10	5
27	301918Z	14.4N 156.4E	SAT			(14.0/4.0-/W /25HRS)			NUN	DAPP									
28	302900Z	15.0N 157.6E	SAT			(14.8/5.8 /W1.0/24HRS)			PCN 1	DAPP									
29	311130Z	15.4N 160.0E	SAT						PCN 1	DAPP									
30	312045Z	16.4N 162.0E	P	10 5	700	180 70	90	4	60	90	6	994	300	16	9	CIRC	20	6	
31	011120Z	18.2N 165.4E	SAT						PCN 1	DAPP									
32	011600Z	18.0N 165.4E	SAT			(12.0/3.0 /W1.0/24HRS)			NUN	DAPP									
33	021939Z	20.3N 172.4E	SAT			(12.0/2.0-/S /23HRS)			NUN	DAPP									

HURRICANE KATHERINE FIX POSITIONS FOR CYCLONE NO. 15 0600Z 30 SEP TO 1800Z 08 OCT

FIX NO.	TIME	POSIT	FIX CAT	ACCHY NAV-MET	FIX LVL	FLT DIR	MAX OBS VEL	MAX OBS WIND HRG	MAX OBS SFC WIND VEL	MAX OBS WIND HRG	OBS MIN SLP	MIN 700MB HGT	FLT LVL	EYE FORM	ORLEN- TATION	EYE DIA	POSIT OF RADAR	MSW NMBR
1	291559Z	12.0N 110.2E	SAT						NUN	DAPP								
2	300043Z	13.4N 113.0E	SAT						PCN 1	DAPP								
3	301053Z	13.4N 114.4E	SAT						NUN	DAPP								
4	301945Z	14.0N 115.4E	SAT						PCN 1	DAPP								
5	301948Z	14.1N 114.4E	P	5	3	700	340	70	40	330	20	978	290	14	12	CIRC	20	1
6	011957Z	15.2N 117.2E	SAT						PCN 1	DAPP								
7	011743Z	15.4N 117.2E	SAT						NUN	DAPP								
8	021539Z	16.4N 119.0E	SAT						PCN 1	DAPP								
9	022103Z	16.4N 120.4E	SAT						PCN 1	DAPP								
10	022103Z	16.4N 120.5E	SAT						PCN 1	DAPP								
11	031707Z	16.4N 124.0E	SAT						PCN 1	DAPP								
12	031737Z	16.4N 124.4E	SAT						NUN	DAPP								
13	051730Z	14.1N 134.5E	SAT						NUN	DAPP								
14	080606Z	13.2N 146.4E	SAT						PCN 1	DAPP								
15	082459Z	13.4N 150.4E	SAT						PCN 1	DAPP								

5. POSITION AND VERIFICATION DATA - HURRICANES

HURRICANE DOREEN

1800Z 17 JUN TO 0000Z 3 AUG

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
TIME	POSIT	WIND		POSIT	WIND	ERRORS DST WIND		POSIT	WIND	ERRORS DST WIND		POSIT	WIND	ERRORS DST WIND		POSIT	WIND	ERRORS DST WIND	
171800Z	10.1N 106.2W	30		9.0N 105.0W	30	97	0	9.0N 109.0W	35	211	-20	---	---	---	---	---	---	---	---
180000Z	10.3N 107.7W	35		10.5N 107.0W	40	43	5	11.4N 113.7W	60	63	-5	12.3N 119.3W	75	86	-5	13.0N 122.0W	75	105	-10
180600Z	10.6N 109.0W	40		10.7N 108.1W	45	53	5	11.5N 113.0W	65	63	-5	12.5N 119.3W	75	86	-5	13.0N 122.0W	75	105	-10
181200Z	10.9N 110.4W	45		11.0N 110.0W	55	26	10	11.7N 115.0W	65	25	-10	11.8N 120.0W	75	114	-10	11.8N 125.5W	75	130	-5
181800Z	11.2N 111.4W	55		11.0N 111.3W	60	32	5	11.3N 116.4W	80	72	5	11.6N 121.0W	85	114	-10	11.8N 127.0W	85	170	-5
190000Z	11.6N 112.9W	65		11.6N 112.3W	65	35	0	12.5N 117.0W	80	34	0	13.5N 127.0W	100	50	15	14.0N 127.0W	100	64	20
190600Z	11.9N 114.0W	70		12.0N 113.5W	70	30	0	12.8N 118.0W	90	52	10	13.5N 127.0W	100	43	15	14.3N 128.0W	100	72	25
191200Z	12.1N 115.1W	75		12.2N 114.7W	100	24	25	13.0N 119.3W	100	63	15	13.8N 124.0W	90	21	10	14.6N 128.7W	80	63	5
191800Z	12.5N 116.7W	75		12.6N 116.1W	100	13	25	14.0N 121.4W	100	12	15	15.3N 124.0W	85	112	5	16.7N 131.8W	75	230	0
200000Z	12.8N 117.4W	80		13.0N 117.4W	100	13	20	14.2N 122.7W	100	34	15	15.5N 127.0W	85	142	5	16.8N 133.0W	75	245	5
200600Z	13.2N 118.7W	80		13.2N 118.7W	100	6	20	14.4N 125.9W	100	34	15	15.8N 129.0W	85	142	5	17.1N 134.1W	75	257	5
201200Z	13.7N 120.1W	85		13.5N 121.3W	100	18	15	15.7N 125.2W	100	116	20	16.1N 130.3W	80	205	5	17.5N 137.5W	60	274	-10
201800Z	14.0N 121.4W	85		14.1N 121.3W	100	18	15	15.6N 125.5W	100	116	20	16.0N 130.3W	80	205	5	17.5N 137.5W	60	274	-10
210000Z	14.1N 122.4W	85		14.5N 122.6W	110	24	25	16.0N 127.5W	90	151	10	17.2N 135.5W	75	242	5	18.5N 137.5W	60	289	-15
210600Z	14.1N 123.4W	85		14.7N 123.7W	90	40	5	16.1N 128.7W	60	180	-15	17.3N 132.5W	50	223	-20	19.0N 139.0W	40	262	-30
211200Z	14.1N 125.1W	80		14.6N 125.0W	80	30	0	15.0N 130.0W	60	92	-15	15.5N 134.0W	40	79	-45	15.5N 138.2W	30	91	-40
220000Z	14.0N 125.9W	80		14.6N 126.3W	80	43	0	15.0N 130.6W	55	71	-15	15.5N 136.5W	45	91	-40	15.7N 139.7W	35	126	-35
220600Z	14.0N 126.9W	75		14.5N 127.5W	80	50	5	14.7N 131.7W	50	60	-20	15.0N 136.0W	40	60	-40	15.0N 140.5W	35	163	-30
221200Z	14.0N 127.4W	75		14.8N 128.5W	75	54	0	14.8N 133.5W	50	43	-25	15.0N 137.0W	40	81	-40	15.0N 141.5W	35	162	-30
221800Z	14.0N 128.4W	75		14.8N 129.1W	75	51	-10	15.3N 133.3W	50	43	-25	15.5N 137.5W	40	55	-40	16.0N 141.5W	35	162	-30
230000Z	14.1N 129.4W	70		15.2N 130.2W	65	70	-5	16.4N 134.0W	50	84	-25	17.6N 137.0W	50	78	-20	18.8N 141.7W	40	134	-10
230600Z	14.2N 130.9W	70		15.3N 132.7W	65	80	-10	16.5N 137.7W	50	173	-20	18.0N 142.0W	50	104	-30	19.3N 142.0W	30	186	-30
231200Z	14.7N 132.9W	75		14.8N 132.7W	60	13	-15	15.0N 136.0W	50	72	-20	15.0N 136.0W	40	121	-45	15.0N 142.5W	30	117	-20
240000Z	15.0N 134.0W	75		14.9N 134.8W	60	47	-15	14.9N 138.8W	60	108	-10	14.9N 142.8W	55	137	5	14.9N 146.8W	45	100	-5
240600Z	15.4N 134.9W	70		15.0N 134.5W	65	33	-5	15.0N 137.5W	65	104	0	15.0N 136.5W	60	190	10	15.0N 141.5W	60	251	10
241200Z	15.7N 135.9W	70		15.0N 135.0W	65	62	-5	15.0N 137.0W	65	167	5	15.0N 136.0W	60	265	5	15.0N 141.0W	60	325	5
241800Z	16.0N 136.7W	70		15.8N 136.7W	55	12	-15	16.6N 141.0W	45	40	-10	17.0N 142.5W	40	122	-10	17.0N 144.0W	35	283	-25
250000Z	16.3N 137.4W	70		15.8N 137.5W	70	30	0	16.3N 141.4W	70	21	20	17.0N 146.3W	65	104	15	17.7N 149.4W	65	288	5
250600Z	16.9N 139.2W	65		16.5N 139.0W	70	30	5	17.1N 143.0W	65	23	10	17.3N 147.0W	60	173	10	18.0N 152.0W	60	302	0
251200Z	16.6N 140.7W	55		17.0N 140.1W	55	26	0	18.5N 144.1W	40	156	-10	19.5N 147.0W	35	366	-25	20.8N 151.0W	30	479	-30
260000Z	16.6N 141.7W	50		16.6N 141.1W	50	6	0	17.7N 145.1W	40	149	-10	18.7N 148.8W	35	338	-25	20.0N 152.3W	30	433	-30
260600Z	16.7N 142.7W	50		16.8N 142.0W	50	18	0	17.8N 147.2W	35	292	-10	18.8N 149.9W	30	491	-30	22.0N 153.4W	20	569	-45
261200Z	16.5N 143.3W	50		16.8N 143.0W	50	25	0	17.8N 147.2W	35	292	-10	18.8N 149.9W	30	491	-30	22.0N 153.4W	20	569	-45
261800Z	16.5N 144.3W	50		17.0N 144.5W	45	67	-5	18.0N 148.6W	35	286	-25	19.7N 155.4W	25	437	-45	---	---	---	---
270000Z	15.2N 145.1W	50		15.5N 145.2W	40	19	-10	15.5N 149.3W	40	165	-20	16.3N 154.5W	35	270	-25	16.9N 157.6W	35	284	-45
270600Z	13.6N 146.8W	50		15.5N 146.2W	40	70	-10	15.4N 150.5W	40	215	-20	16.5N 154.0W	35	274	-40	17.1N 158.8W	35	297	-45
271200Z	13.6N 147.7W	50		14.1N 146.5W	40	12	-15	15.4N 150.5W	40	116	-20	16.3N 154.7W	35	162	-40	17.4N 158.8W	35	293	-45
271800Z	13.4N 147.7W	60		13.7N 147.3W	40	19	-20	13.3N 151.6W	40	119	-20	13.3N 156.9W	40	182	-45	14.0N 160.0W	40	201	-45
280000Z	13.1N 147.9W	60		13.3N 148.0W	75	13	15	13.3N 152.2W	85	112	25	13.3N 154.3W	85	157	5	13.9N 160.5W	75	162	-5
280600Z	12.9N 148.7W	60		13.3N 149.0W	75	47	15	13.3N 153.2W	85	116	25	13.4N 157.4W	85	169	5	14.0N 161.5W	75	172	-5
281200Z	12.8N 148.7W	60		12.7N 148.8W	75	8	15	12.5N 153.0W	85	80	15	12.8N 157.2W	85	146	0	13.5N 161.3W	75	159	5
281800Z	12.9N 149.6W	60		12.5N 149.7W	75	25	15	12.5N 153.1W	85	80	15	12.7N 154.5W	85	146	0	13.3N 159.7W	75	211	5
290000Z	13.0N 150.3W	60		13.0N 150.3W	90	0	30	13.6N 153.7W	90	24	10	14.5N 157.0W	90	55	10	15.6N 160.2W	90	186	30
290600Z	13.3N 151.2W	65		13.1N 151.2W	90	12	25	13.7N 154.6W	90	40	10	14.8N 157.9W	90	68	15	15.7N 161.2W	90	781	30
291200Z	13.8N 152.4W	70		13.2N 152.5W	100	34	20	14.1N 155.6W	100	47	20	15.5N 162.8W	100	142	30	16.8N 161.3W	100	313	50
300000Z	14.0N 153.7W	80		13.9N 153.2W	100	30	20	15.4N 156.6W	100	73	20	16.9N 159.9W	100	189	40	18.4N 163.5W	100	296	60
300600Z	14.2N 154.6W	80		14.2N 154.0W	100	35	20	15.4N 157.7W	100	104	25	16.7N 160.2W	100	262	45	17.9N 163.3W	100	274	65
301200Z	14.5N 155.4W	80		14.4N 155.8W	90	24	10	15.4N 159.8W	90	25	20	16.3N 164.6W	80	178	40	17.2N 163.8W	80	245	80
301800Z	14.7N 156.4W	85		14.5N 156.8W	90	17	5	15.6N 160.9W	90	63	25	16.6N 164.9W	90	183	45	17.5N 169.0W	90	255	60
310000Z	15.0N 157.4W	80		15.1N 157.8W	75	6	-5	16.8N 162.1W	65	63	5	18.5N 164.3W	60	139	20	20.2N 170.6W	55	169	30
310600Z	15.4N 158.9W	75		15.5N 158.9W	75	6	0	17.2N 163.2W	65	89	10	18.9N 167.4W	60	135	25	---	---	---	---
311200Z	15.8N 159.9W	70		15.8N 160.1W	75	11	5	17.2N 164.3W	70	124	20	18.6N 168.0W	60	152	40	---	---	---	---
311800Z	16.2N 161.4W	65		16.3N 161.4W	75	24	10	17.9N 166.2W	65	80	20	19.6N 171.0W	60	86	40	---	---	---	---
010000Z	16.8N 163.7W	60		16.8N 163.1W	65	6	5	18.7N 169.1W	65	29	25	20.6N 175.2W	55	116	30	---	---	---	---
010600Z	17.6N 164.7W	55		17.3N 164.6W	65	19	10	19.1N 170.6W	65	70	30	---	---	---	---	---	---	---	---
011200Z	18.2N 167.2W	45		18.3N 168.2W	60	54	10	19.4N 172.8W	50	109	20	---	---	---	---	---	---	---	---
020000Z	19.0N 168.7W	40		18.7N 168.3W	50	29	10	20.7N 174.2W	30	82	5	---	---	---	---	---	---	---	---
020600Z	19.8N 169.6W	35		19.1N 169.7W	45	42	10	---	---	---	---	---	---	---	---	---	---	---	---
021200Z	20.4N 170.5W	30		20.4N 170.6W	35	6	5	---	---	---	---	---	---	---	---	---	---	---	---
021800Z	20.6N 172.1W	30		21.0N 172.0W	35	25	5	---	---	---	---	---	---	---	---	---	---	---	---
030000Z	19.5N 173.5W	25		19.6N 173.5W	35	6	10	---	---	---	---	---	---	---	---	---	---	---	---

HURRICANES WHILE WIND OVER 35KTS

WARNING	
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HURRICANE KATHERINE

1200Z 24 SEP TO 1800Z 8 OCT

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
TIME	POSIT	WIND	WIND	POSIT	WIND	WIND	WIND	POSIT	WIND	WIND	WIND	POSIT	WIND	WIND	WIND	POSIT	WIND	WIND	WIND
291200Z	11.8N 109.4W	30	11.7N 110.0W	30	29	5	13.4N 113.6W	30	33	-30	---	---	---	---	---	---	---	---	---
291800Z	12.1N 110.2W	35	11.8N 110.6W	40	29	5	14.0N 113.9W	60	47	-5	17.4N 114.0W	60	150	-30	21.2N 116.3W	50	343	-40	---
300000Z	12.8N 111.7W	40	12.1N 111.2W	45	42	5	15.0N 115.0W	65	61	-10	19.4N 114.5W	60	220	-30	23.0N 116.3W	60	453	-25	---
301200Z	13.3N 115.2W	50	13.6N 115.1W	50	17	-10	16.2N 115.4W	70	104	-25	20.9N 115.5W	75	259	-15	23.5N 115.3W	80	530	-35	---
301800Z	13.9N 114.7W	65	13.9N 114.8W	60	6	-5	15.3N 119.5W	55	104	-35	16.5N 124.2W	50	230	-40	16.8N 129.3W	45	292	-35	---
010000Z	14.1N 115.5W	75	14.3N 116.0W	80	31	-15	15.5N 120.7W	75	148	-15	16.4N 125.0W	70	259	-15	16.6N 130.5W	65	275	-5	---
010600Z	14.7N 116.2W	80	14.6N 116.3W	70	8	-10	15.8N 120.4W	70	98	-15	16.3N 124.8W	70	171	-15	16.8N 129.0W	65	115	---	---
011200Z	15.5N 117.7W	95	15.3N 117.5W	70	26	-10	17.1N 120.2W	70	200	-25	18.5N 125.3W	95	231	-20	22.0N 129.5W	80	525	15	---
020000Z	16.1N 118.2W	90	16.0N 118.0W	85	13	-5	18.5N 120.0W	75	114	-10	21.5N 121.5W	60	386	-10	25.0N 122.0W	40	777	5	---
020600Z	16.6N 118.9W	90	16.2N 118.8W	85	25	-5	18.0N 122.5W	80	99	-5	19.5N 124.5W	65	300	25	20.5N 129.5W	45	254	10	---
021200Z	16.9N 119.9W	95	16.5N 119.5W	85	85	---	18.1N 122.3W	80	74	---	20.1N 124.5W	65	330	15	22.5N 127.2W	50	588	20	---
021800Z	16.8N 120.7W	90	16.5N 120.3W	85	19	-5	18.0N 123.0W	75	99	-5	19.3N 124.7W	80	330	40	21.0N 129.0W	50	519	20	---
030000Z	16.9N 121.1W	85	17.1N 120.9W	80	17	-5	18.5N 124.0W	55	158	-15	20.0N 127.0W	40	371	5	21.0N 130.5W	30	510	0	---
030600Z	17.0N 121.9W	85	17.3N 121.3W	75	29	-10	18.8N 124.7W	50	207	-10	20.3N 128.0W	40	406	25	21.5N 131.5W	30	553	0	---
031200Z	17.0N 122.5W	85	17.7N 122.4W	75	51	-10	19.0N 125.4W	55	261	5	19.9N 128.7W	45	424	15	20.0N 132.0W	30	518	0	---
031800Z	16.8N 124.7W	80	16.8N 124.7W	65	29	-15	15.9N 129.1W	55	50	15	15.2N 137.5W	50	83	20	14.6N 138.0W	45	96	15	---
040000Z	16.4N 125.7W	70	16.6N 125.7W	65	12	-5	15.7N 130.0W	55	68	20	15.0N 135.0W	50	76	20	14.0N 139.0W	45	86	15	---
040600Z	16.2N 127.1W	60	16.4N 127.0W	60	13	0	15.5N 132.0W	45	43	10	15.0N 137.0W	40	72	10	14.5N 142.0W	40	83	10	---
041200Z	15.7N 128.4W	50	16.1N 128.2W	55	27	5	15.2N 133.3W	40	48	10	14.2N 138.2W	30	43	0	13.5N 143.2W	25	29	-5	---
041800Z	15.4N 129.4W	40	15.7N 129.7W	55	19	15	15.0N 135.5W	40	75	10	17.0N 141.0W	35	241	5	20.0N 146.0W	35	429	---	---
050000Z	15.1N 131.0W	35	15.7N 129.9W	50	73	15	15.0N 137.0W	40	92	10	17.5N 142.0W	35	269	5	20.5N 147.0W	30	455	0	---
050600Z	14.8N 132.2W	35	15.2N 132.0W	50	27	15	15.0N 137.5W	45	80	15	17.0N 142.0W	40	229	40	19.0N 146.0W	35	347	5	---
051200Z	14.4N 133.4W	30	15.3N 132.2W	50	88	20	14.9N 138.7W	45	93	15	15.5N 143.0W	40	145	10	18.0N 147.7W	35	281	10	---
051800Z	14.2N 134.5W	30	14.2N 134.5W	50	0	20	13.0N 138.3W	40	52	10	12.0N 142.0W	40	119	10	15.4N 162.3W	35	767	10	---
060000Z	14.0N 135.4W	30	14.1N 135.6W	45	13	15	12.5N 141.0W	35	63	5	12.0N 146.0W	30	84	0	---	---	---	---	
060600Z	13.8N 136.9W	30	14.0N 137.5W	40	27	10	12.8N 142.5W	35	75	-5	15.0N 145.0W	25	131	-5	---	---	---	---	
061200Z	13.5N 138.0W	30	14.5N 138.7W	40	77	10	12.8N 142.5W	30	155	0	17.5N 148.0W	25	281	0	---	---	---	---	
061800Z	13.4N 139.1W	30	13.0N 139.8W	50	47	20	12.5N 143.8W	50	36	20	11.8N 147.7W	50	130	25	---	---	---	---	
070000Z	13.3N 140.3W	30	12.6N 141.0W	50	58	20	11.8N 146.5W	50	113	20	---	---	---	---	---	---	---	---	
070600Z	13.2N 141.4W	30	12.5N 142.0W	45	51	15	12.5N 147.0W	40	58	10	---	---	---	---	---	---	---	---	
071200Z	13.2N 142.0W	30	13.1N 143.2W	40	24	10	13.0N 148.2W	35	43	10	---	---	---	---	---	---	---	---	
071800Z	13.1N 143.9W	30	12.9N 144.1W	35	17	5	13.0N 148.2W	35	63	10	---	---	---	---	---	---	---	---	
080000Z	13.1N 145.1W	30	13.3N 146.3W	35	71	5	---	---	---	---	---	---	---	---	---	---	---	---	
080600Z	13.2N 146.3W	30	13.4N 146.8W	35	31	5	---	---	---	---	---	---	---	---	---	---	---	---	
081200Z	13.3N 147.4W	25	13.6N 148.2W	35	29	10	---	---	---	---	---	---	---	---	---	---	---	---	
081800Z	13.4N 149.2W	25	13.5N 148.0W	30	70	5	---	---	---	---	---	---	---	---	---	---	---	---	

HURRICANES WHILE WIND OVER 35KTS

AVERAGE FORECAST ERROR	WARNING				24-HR				48-HR				72-HR			
	30NM	104NM	276NM	442NM	18NM	65NM	176NM	328NM	19NM	65NM	176NM	328NM	19NM	65NM	176NM	328NM
AVERAGE RIGHT ANGLE ERROR	18NM	65NM	176NM	328NM	18NM	65NM	176NM	328NM	18NM	65NM	176NM	328NM	18NM	65NM	176NM	328NM
AVERAGE MAGNITUDE OF WIND ERROR	8KTS	16KTS	19KTS	20KTS	8KTS	16KTS	19KTS	20KTS	8KTS	16KTS	19KTS	20KTS	8KTS	16KTS	19KTS	20KTS
AVERAGE BIAS OF WIND ERROR	-3KTS	-9KTS	-10KTS	-10KTS	-3KTS	-9KTS	-10KTS	-10KTS	-3KTS	-9KTS	-10KTS	-10KTS	-3KTS	-9KTS	-10KTS	-10KTS
NUMBER OF FORECASTS	23	20	15	11	23	20	15	11	23	20	15	11	23	20	15	11

ALL FORECASTS

	WARNING				24-HR				48-HR				72-HR			
	35NM	62NM	222NM	405NM	19NM	42NM	157NM	308NM	10KTS	13KTS	15KTS	30KTS	10KTS	13KTS	15KTS	30KTS
AVERAGE FORECAST ERROR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
AVERAGE RIGHT ANGLE ERROR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
AVERAGE MAGNITUDE OF WIND ERROR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
AVERAGE BIAS OF WIND ERROR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
NUMBER OF FORECASTS	38	34	29	25	---	---	---	---	---	---	---	---	---	---	---	---

ANNEX B

BAY OF BENGAL TROPICAL CYCLONES

1. SUMMARY OF DATA ¹

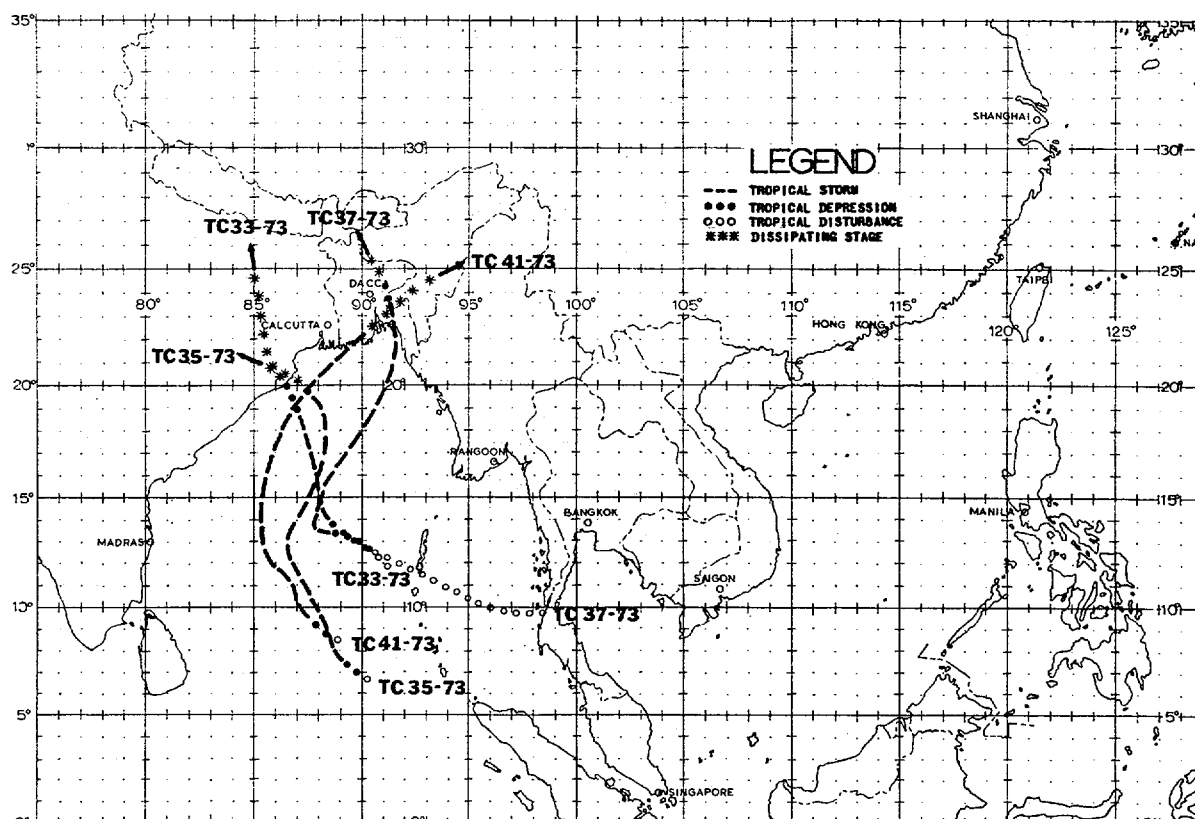


FIGURE B-1. Composite chart of best tracks for the Bay of Bengal.

TABLE B-1. 1973 BAY OF BENGAL TROPICAL CYCLONES						
CYCLONE	INCLUSIVE DATES	MAX SFC WND	MIN OBS SLP	NO. OF WARNINGS ISSUED	REMARKS	
33-73	08 OCT - 12 OCT	40	---	9	-----	
35-73	04 NOV - 09 NOV	70	988	13	-----	
37-73	15 NOV - 17 NOV	55	---	4	FORMERLY TS SARAH	
41-73	05 DEC - 09 DEC	60	---	8	-----	

¹Tropical cyclones in the Bay of Bengal are numbered consecutively from the beginning of the calendar year and are included with those developing in the South Pacific and Indian oceans. The JTWC area of responsibility in the Bay of Bengal includes the area north of the equator from the Malay Peninsula to 90°E. The JTWC issued two warnings in the Bay of Bengal during 1973 when T.C. 33-73 went ashore east of Dacca and when T.C. 35-73 was forecast to recurve and move eastward into the JTWC's area of responsibility. All other warnings were issued by FLEWEACEN Guam. All Bay of Bengal cyclones for 1973 are included in Annex B.

2. TROPICAL CYCLONE TRACKS

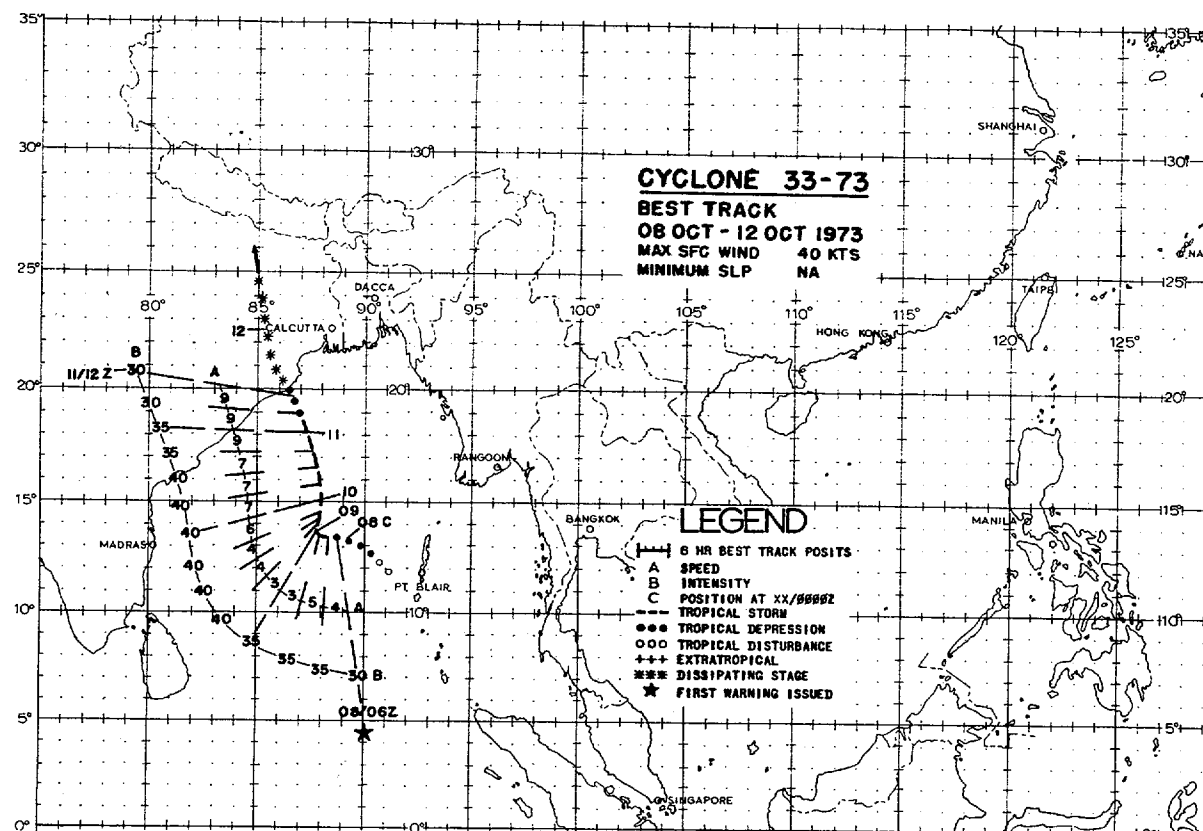


FIGURE B-2. Best track chart for Tropical Cyclone 33-73.

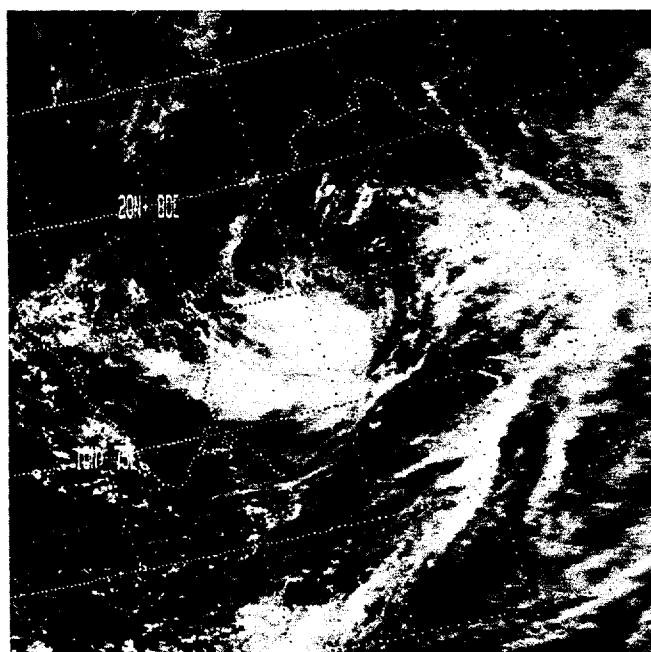


FIGURE B-3. NOAA-2 imagery of Tropical Cyclone 33-73, 9 October 1973, 0353 GMT.

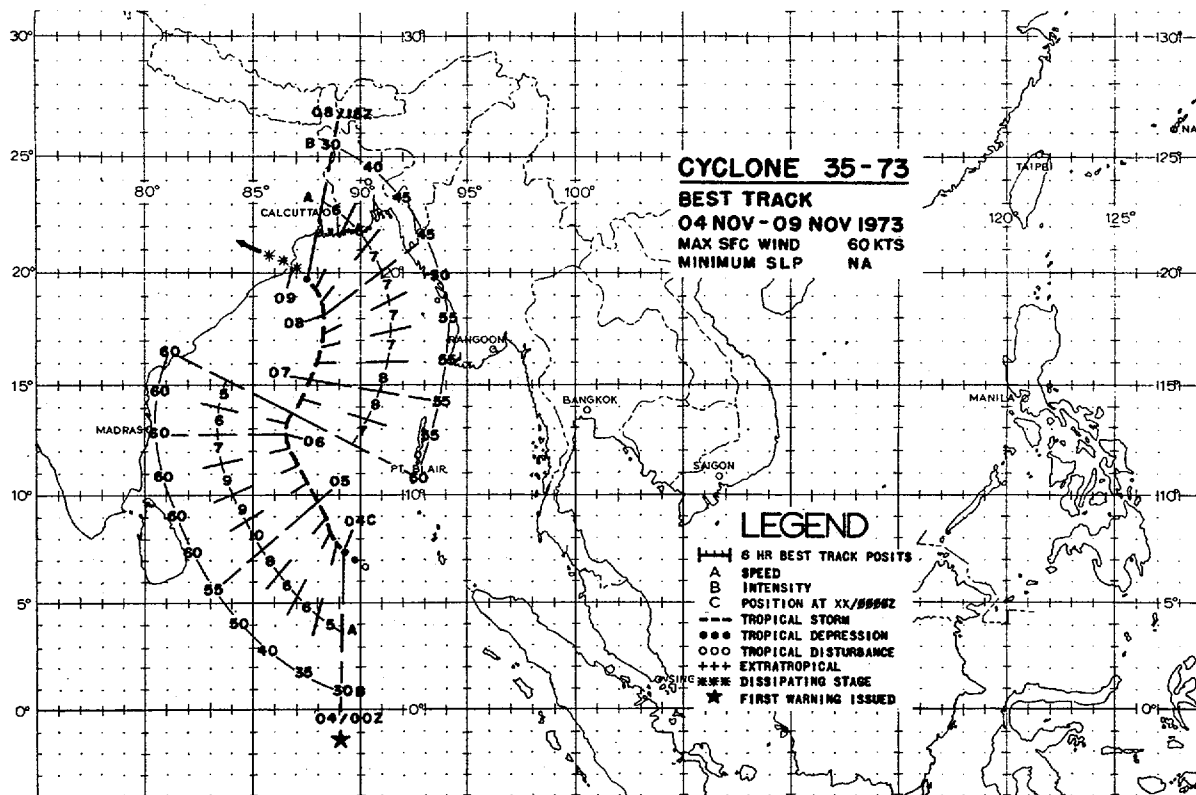


FIGURE B-4. Best track chart for Tropical Cyclone 35-73.



FIGURE B-5. DMSP imagery of Tropical Cyclone 35-73, 8 November 1973, 0243 GMT.

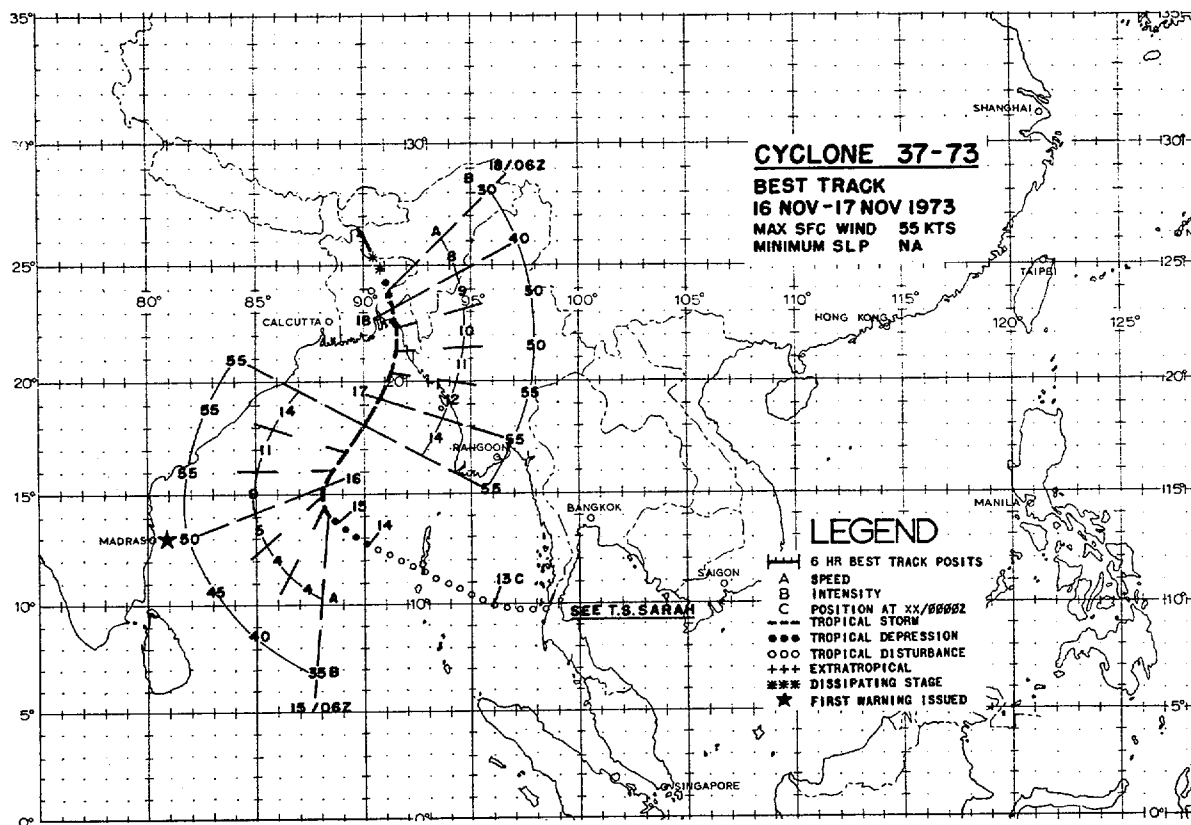


FIGURE B-6. Best track chart for Tropical Cyclone 37-73.

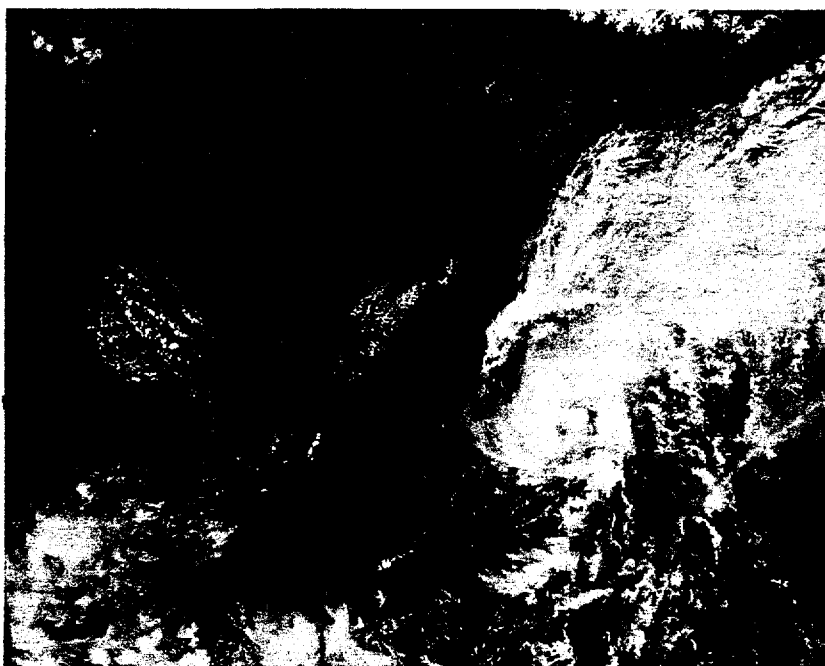


FIGURE B-7. DMSP imagery of Tropical Cyclone 37-73, 16 November 1973, 0159 GMT.

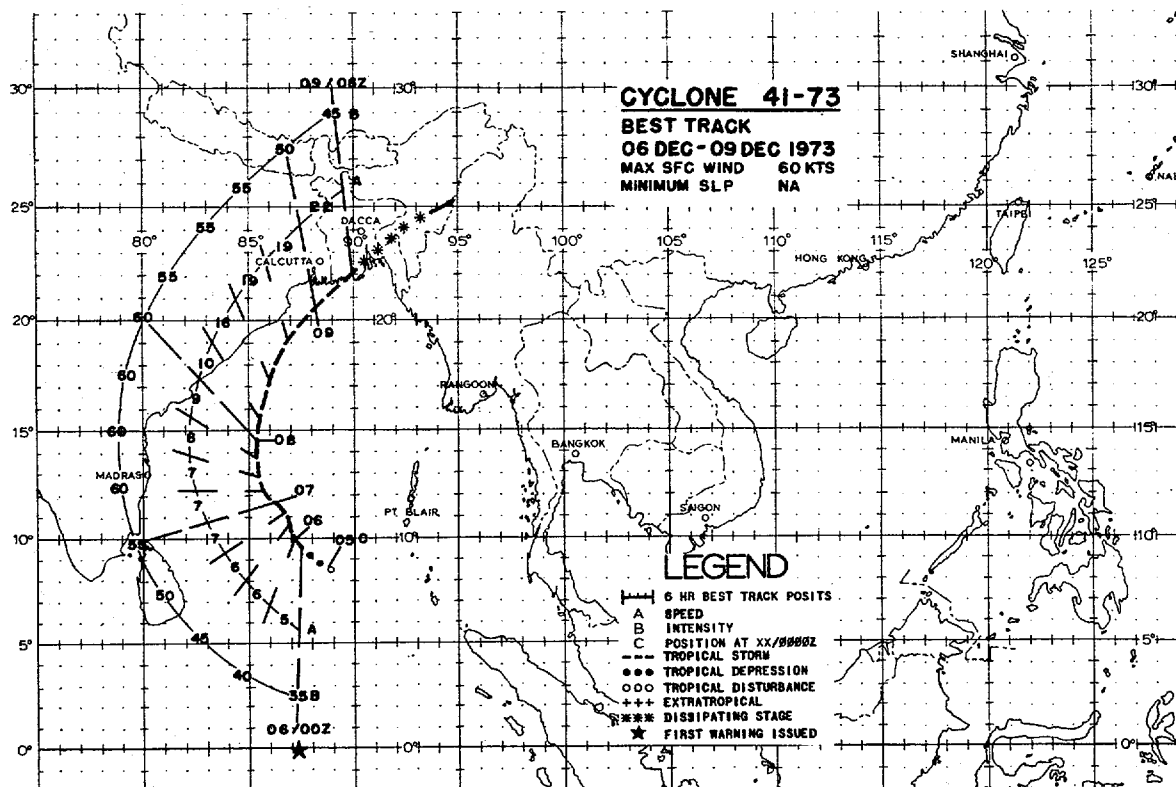


FIGURE B-8. Best track chart for Tropical Cyclone 41-73.

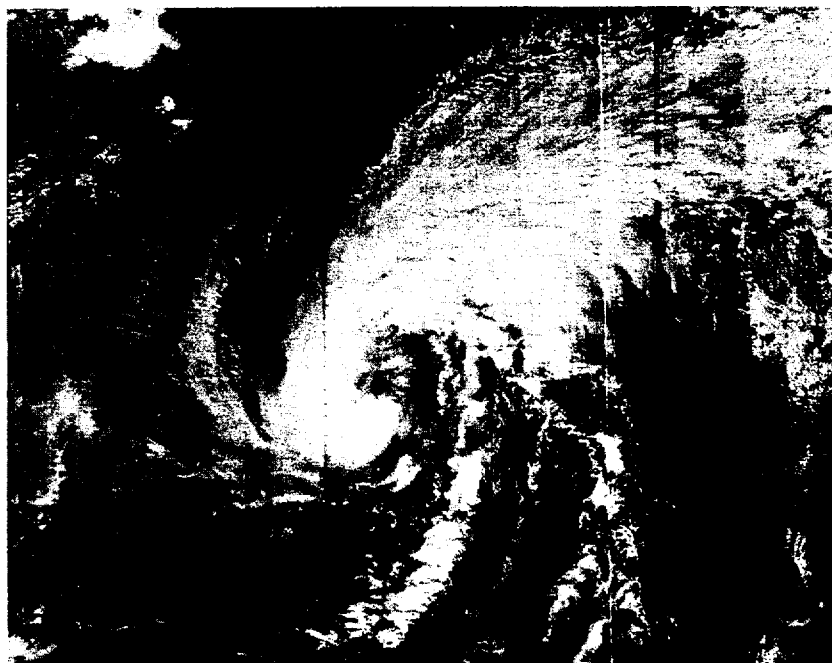


FIGURE B-9. DMSP imagery of Tropical Cyclone 41-73, 8 December 1973, 0621 GMT.

3. CENTER FIX DATA

TROPICAL CYCLONE 33-73 FIX POSITIONS FOR CYCLONE NO. 33-73 0600Z 08 OCT TO 0600Z 12 OCT

FIX NO.	TIME	POSIT	FIX CAT	ACCR MET	Fix Lvl	MAX OBS DIR VEL	MAX OBS LVL WIND	MAX OBS SFC WIND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	OBIEN- TATION	EYE DIA	POSIT OF RADAR	MSL NUMB
1	060137	18.4N 927.0E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
2	081237	28.4N 527.5E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
3	081337	38.4N 30.0E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
4	090137	58.7N 833.5E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
5	090137	88.7N 801.5E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
6	091247	28.7N 901.5E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
7	091347	58.4N 100.5E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
8	1000157	18.4N 126.0E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
9	1000157	88.7N 935.0E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
10	1012167	58.7N 835.0E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
11	1013172	38.7N 634.5E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
12	1100182	18.7N 434.0E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
13	1106182	98.7N 33.5E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
14	1112192	78.4N 533.5E	SAT	(T 0/ 0 /	/	MRS)	PCN 3	DMSP								
15	1118202	98.5N 833.0E	SAT	(T 0/ 6.0 /	/	MRS)	PCN 3	DMSP								
16	1200237	58.5N 234.5E	SAT	(T 0/ 6.0 /	/	MRS)	PCN 3	DMSP								

TROPICAL CYCLONE 35-73 FIX POSITIONS FOR CYCLONE NO. 35-73 0000Z 04 NOV TO 1200Z 09 NOV

FIX NO.	TIME	POSIT	FIX CAT	ACCR MET	Fix Lvl	MAX OBS DIR VEL	MAX OBS LVL WIND	MAX OBS SFC WIND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	OBIEN- TATION	EYE DIA	POSIT OF RADAR	MSL NUMB
1	400072	58.4N 131.5E	SAT	(T 0/ 6.0 /	/	MRS)	PCN 3	DMSP								
2	406072	88.4N 832.5E	SAT	(T 0/ 6.0 /	/	MRS)	PCN 3	DMSP								
3	412002	38.4N 533.5E	SAT	(T 0/ 6.0 /	/	MRS)	PCN 3	DMSP								
4	418082	98.4N 334.0E	SAT	(T 0/ 6.0 /	/	MRS)	PCN 3	DMSP								
5	500092	78.4N 33.5E	SAT	(T 0/ 6.0 /	/	MRS)	PCN 3	DMSP								
6	0508102	68.7N 533.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
7	512112	38.7N 133.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
8	518122	18.4N 633.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
9	600122	88.6N 536.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
10	608132	38.6N 602.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
11	612132	88.6N 803.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
12	618142	48.7N 303.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
13	700152	28.7N 702.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
14	708162	18.4N 2.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
15	712162	78.4N 200.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
16	718172	48.4N 300.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
17	800182	28.4N 335.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
18	806182	88.4N 133.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
19	808182	98.4N 133.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
20	812192	38.7N 933.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
21	818192	78.7N 531.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
22	900202	28.6N 930.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								

TROPICAL CYCLONE 37-73 FIX POSITIONS FOR CYCLONE NO. 37-73 0000Z 16 NOV TO 0800Z 17 NOV

FIX NO.	TIME	POSIT	FIX CAT	ACCR MET	Fix Lvl	MAX OBS DIR VEL	MAX OBS LVL WIND	MAX OBS SFC WIND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	OBIEN- TATION	EYE DIA	POSIT OF RADAR	MSL NUMB
1	1600192	38.4N 136.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
2	1605162	18.4N 504.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
3	1612162	98.4N 103.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
4	1618182	8.4N 903.5E	SAT	(T 0/ 2.0 /	/	MRS)	PCN 3	DMSP								
5	1700192	29.4N 703.0E	SAT	(T 0/ 2.0 /	/	MRS)	PCN 3	DMSP								
6	1708202	29.1N 201.5E	SAT	(T 0/ 2.0 /	/	MRS)	PCN 3	DMSP								
7	1708202	49.1N 301.5E	SAT	(T 0/ 2.0 /	/	MRS)	PCN 3	DMSP								
8	1712212	39.1N 401.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
9	1718222	39.1N 536.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
10	1800232	19.1N 435.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
11	1808232	49.1N 232.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
12	1812242	69.0N 933.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								

TROPICAL CYCLONE 41-73 FIX POSITIONS FOR CYCLONE NO. 41-73 0000Z 06 DEC TO 1200Z 09 DEC

FIX NO.	TIME	POSIT	FIX CAT	ACCR MET	Fix Lvl	MAX OBS DIR VEL	MAX OBS LVL WIND	MAX OBS SFC WIND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TI/TO	EYE FORM	OBIEN- TATION	EYE DIA	POSIT OF RADAR	MSL NUMB
1	600092	78.7N 531.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
2	608102	18.7N 232.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
3	612102	68.6N 933.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
4	618112	28.4N 632.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
5	700112	78.4N 231.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
6	708122	28.5N 732.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
7	712122	98.5N 534.5E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
8	718132	78.5N 335.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
9	800142	68.5N 301.0E	SAT	(T 0/ 1.0 /	/	MRS)	PCN 3	DMSP								
10	808152	68.5N 601.5E	SAT	(T 0/ 2.5 /	/	MRS)	PCN 3	DMSP								
11	812172	38.6N 1.5E	SAT	(T 0/ 2.5 /	/	MRS)	PCN 3	DMSP								
12	818192	28.4N 803.0E	SAT	(T 0/ 5.5 /	/	MRS)	PCN 3	DMSP								
13	9000202	68.4N 105.0E	SAT	(T 0/ 6.5 /	/	MRS)	PCN 3	DMSP								
14	908222	18.4N 905.0E	SAT	(T 0/ 7.0 /	/	MRS)	PCN 3	DMSP								
15	0912232	49.1N 505.0E	SAT	(T 0/ 7.0 /	/	MRS)	PCN 3	DMSP								

4. POSITION AND VERIFICATION DATA

TROPICAL CYCLONE 33-73
0600Z 08 OCT TO 0000Z 12 OCT

	BEST TRACK				WARNING				24 HOUR FORECAST ERRORS				48 HOUR FORECAST ERRORS				72 HOUR FORECAST ERRORS			
	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND
080600Z	13.1N	88.9E	30	13.1N	88.6E	35	17	13.9N	86.2E	45	93	15.2N	83.6E	55	254	15	15.2N	83.6E	55	254
081200Z	13.2N	88.5E	35	14.0N	88.0E	35	56	16.1N	85.7E	45	170	18.5N	83.9E	45	252	5	18.5N	83.9E	45	252
081800Z	13.3N	88.0E	35	14.0N	88.0E	35	56	16.1N	85.7E	45	170	18.5N	83.9E	45	252	5	18.5N	83.9E	45	252
090000Z	13.5N	87.9E	35	13.3N	87.5E	35	21	14.2N	86.1E	45	127	15.0N	84.7E	45	241	10	15.0N	84.7E	45	241
090600Z	13.8N	87.9E	40	13.8N	87.3E	40	42	14.4N	86.1E	60	159	15.2N	85.0E	65	287	35	15.2N	85.0E	65	287
091200Z	14.2N	87.9E	40	13.8N	87.3E	40	42	14.4N	86.1E	60	159	15.2N	85.0E	65	287	35	15.2N	85.0E	65	287
091800Z	14.5N	88.1E	40	14.4N	88.1E	40	42	15.4N	88.7E	60	178	16.4N	89.0E	65	464	40	16.4N	89.0E	65	464
100600Z	15.1N	88.1E	40	14.4N	88.1E	40	42	15.4N	88.7E	60	178	16.4N	89.0E	65	464	40	16.4N	89.0E	65	464
100600Z	15.8N	87.9E	40	16.0N	88.3E	40	41	17.6N	88.5E	45	169	18.5N	88.5E	45	169	15	18.5N	88.5E	45	169
101200Z	16.5N	87.9E	40	16.0N	88.3E	40	41	17.6N	88.5E	45	169	18.5N	88.5E	45	169	15	18.5N	88.5E	45	169
101800Z	17.3N	87.9E	35	17.5N	86.8E	40	49	19.8N	86.3E	50	229	21.5N	86.3E	50	229	25	21.5N	86.3E	50	229
110000Z	18.1N	87.4E	35	17.5N	86.8E	40	49	19.8N	86.3E	50	229	21.5N	86.3E	50	229	25	21.5N	86.3E	50	229
110600Z	18.9N	87.0E	30	18.7N	86.5E	45	60	19.8N	86.3E	50	229	21.5N	86.3E	50	229	25	21.5N	86.3E	50	229
111200Z	19.7N	86.5E	30	18.7N	86.5E	45	60	19.8N	86.3E	50	229	21.5N	86.3E	50	229	25	21.5N	86.3E	50	229
111800Z	20.9N	85.9E	25	21.5N	86.8E	35	149	21.5N	86.8E	35	149	21.5N	86.8E	35	149	10	21.5N	86.8E	35	149
120000Z	23.5N	85.7E	25	21.5N	86.8E	35	149	21.5N	86.8E	35	149	21.5N	86.8E	35	149	10	21.5N	86.8E	35	149

ALL FORECASTS				
WARNING	24-HR	48-HR	72-HR	
53NM	161NM	29NM	0NM	
26NM	85NM	17NM	0NM	
4KTS	14KTS	21KTS	0KTS	
4KTS	14KTS	21KTS	0KTS	
9	7	5	0	

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

TROPICAL CYCLONE 35-73

0000Z 04 NOV TO 1200Z 09 NOV

	BEST TRACK				WARNING				24 HOUR FORECAST ERRORS				48 HOUR FORECAST ERRORS				72 HOUR FORECAST ERRORS						
	POSIT	WIND			POSIT	WIND			POSIT	WIND			POSIT	WIND			POSIT	WIND					
040000Z	7.5N	89.1E	30		7.2N	89.4E	35		7.7N	87.1E	40	131	8.2N	85.1E	45	287	15	8.2N	85.1E	45	287		
040600Z	7.8N	88.9E	35		7.7N	87.5E	40	69	8.9N	84.8E	60	197	9.8N	82.5E	75	347	15	9.8N	82.5E	75	347		
041200Z	8.3N	88.5E	40		8.3N	87.5E	40	69	8.9N	84.8E	60	197	9.8N	82.5E	75	347	15	9.8N	82.5E	75	347		
041800Z	8.3N	88.5E	40		8.3N	87.5E	40	69	8.9N	84.8E	60	197	9.8N	82.5E	75	347	15	9.8N	82.5E	75	347		
050000Z	9.7N	88.0E	55	5	8.3N	85.8E	45	154	9.8N	82.5E	65	295	10.8N	79.1E	40	565	15	10.8N	79.1E	40	565		
050600Z	10.6N	87.9E	60	10	10.7N	87.4E	50	8	14.3N	88.2E	70	110	18.1N	89.3E	80	141	25	18.1N	89.3E	80	141		
051200Z	11.3N	87.1E	60	11	11.6N	87.7E	55	39	15.3N	88.4E	75	129	19.0N	89.7E	80	162	25	19.0N	89.7E	80	162		
051800Z	12.1N	86.6E	60	12	12.1N	86.6E	60	42	17.8N	86.6E	80	112	21.0N	87.6E	80	107	40	21.0N	87.6E	80	107		
060000Z	12.8N	86.4E	60	13	13.4N	87.9E	60	89	17.2N	89.1E	75	144	20.5N	90.4E	80	194	35	20.5N	90.4E	80	194		
060600Z	13.3N	86.6E	60	14	14.2N	86.2E	70	42	17.8N	86.6E	80	112	21.0N	87.6E	80	107	40	21.0N	87.6E	80	107		
061200Z	13.8N	86.6E	60	14	14.2N	86.2E	70	42	17.8N	86.6E	80	112	21.0N	87.6E	80	107	40	21.0N	87.6E	80	107		
061800Z	14.4N	87.3E	55	15	15.4N	86.4E	80	76	19.4N	89.5E	70	99	25	19.4N	89.5E	70	99	25	19.4N	89.5E	70	99	
070000Z	15.2N	87.7E	55	15	15.4N	86.4E	80	76	19.4N	89.5E	70	99	25	19.4N	89.5E	70	99	25	19.4N	89.5E	70	99	
070600Z	16.3N	88.9E	55	17	17.1N	87.3E	75	57	21.5N	93.1E	40	319	0	21.5N	93.1E	40	319	0	21.5N	93.1E	40	319	
071200Z	16.3N	88.9E	55	17	17.1N	87.3E	75	57	21.5N	93.1E	40	319	0	21.5N	93.1E	40	319	0	21.5N	93.1E	40	319	
071800Z	17.4N	88.3E	50	19	19.3N	90.2E	70	126	25	19.3N	90.2E	70	126	25	19.3N	90.2E	70	126	25	19.3N	90.2E	70	126
080000Z	18.2N	88.3E	45	19	19.3N	90.2E	70	126	25	19.3N	90.2E	70	126	25	19.3N	90.2E	70	126	25	19.3N	90.2E	70	126
080600Z	18.9N	88.1E	45	18	18.6N	90.5E	60	137	15	18.6N	90.5E	60	137	15	18.6N	90.5E	60	137	15	18.6N	90.5E	60	137
081200Z	19.3N	87.4E	40	19	19.6N	88.9E	55	79	25	19.6N	88.9E	55	79	25	19.6N	88.9E	55	79	25	19.6N	88.9E	55	79
081800Z	19.7N	87.4E	30	19	19.6N	88.9E	55	79	25	19.6N	88.9E	55	79	25	19.6N	88.9E	55	79	25	19.6N	88.9E	55	79
090000Z	20.2N	86.4E	25	19	19.5N	88.5E	55	99	30	19.5N	88.5E	55	99	30	19.5N	88.5E	55	99	30	19.5N	88.5E	55	99

ALL FORECASTS				
WARNING	24-HR	48-HR	72-HR	
77NM	171NM	25NM	0NM	
68NM	132NM	18NM	0NM	
14KTS	13KTS	24KTS	0KTS	
10KTS	8KTS	10KTS	0KTS	
13	5	7	0	

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

TROPICAL CYCLONE 37-73
0000Z 16 NOV TO 0800Z 17 NOV

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
TIME	POSIT	WIND	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND	POSIT	WIND
160000Z	15.3N	88.1E	50	15.0N	87.9E	60	21	16.5N	86.8E	75	274	20	---	---	---	---	---	---	---
160600Z	16.1N	88.5E	55	16.3N	88.2E	60	63	16.5N	86.8E	75	274	20	---	---	---	---	---	---	---
161200Z	16.1N	89.1E	55	16.3N	88.2E	60	63	16.5N	86.8E	75	274	20	---	---	---	---	---	---	---
161800Z	16.0N	89.9E	55	16.3N	88.2E	60	63	16.5N	86.8E	75	274	20	---	---	---	---	---	---	---
170000Z	19.2N	90.7E	55	18.6N	89.1E	60	27	19.2N	90.7E	55	18.6N	89.1E	60	27	19.2N	90.7E	55	18.6N	89.1E
170600Z	20.4N	91.3E	55	20.5N	91.8E	60	29	20.4N	91.3E	55	20.5N	91.8E	60	29	20.4N	91.3E	55	20.5N	91.8E

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
52NM 27NM 0NM 0NM
38NM 27NM 0NM 0NM
6KTS 20KTS 0KTS 0KTS
6KTS 20KTS 0KTS 0KTS
4 1 0 0

TROPICAL CYCLONE 41-73
0000Z 06 DEC TO 1200Z 09 DEC

BEST TRACK				WARNING				24 HOUR FORECAST				48 HOUR FORECAST				72 HOUR FORECAST			
	POSIT	WIND		POSIT	WIND	ERRORS		POSIT	WIND	ERRORS		POSIT	WIND	ERRORS		POSIT	WIND	ERRORS	
060000Z	9.7N	87.5E	35	7.1N	87.0E	40	158	5	7.8N	85.2E	50	240	15	8.5N	83.5E	60	379	0	
060600Z	10.1N	87.2E	40	10.2N	87.2E	40	48	0	10.9N	85.3E	50	117	10	11.6N	84.1E	60	314	0	
061200Z	11.2N	86.6E	50	10.2N	87.6E	40	48	0	11.2N	86.5E	55	117	10	12.6N	85.1E	65	560	20	
070000Z	11.7N	86.2E	55	11.4N	87.1E	45	53	10	13.9N	87.1E	50	112	10	15.7N	88.2E	65	293	15	
070600Z	12.2N	85.7E	60	12.7N	85.0E	45	31	15	15.2N	83.9E	60	174	5	17.3N	83.4E	65	560	75	
071200Z	12.5N	85.6E	60	12.7N	85.0E	45	31	15	15.2N	83.9E	60	174	5	17.3N	83.4E	65	560	75	
071800Z	13.7N	85.3E	60	12.7N	85.0E	45	31	15	15.2N	83.9E	60	174	5	17.3N	83.4E	65	560	75	
080000Z	14.6N	85.7E	60	14.0N	85.1E	60	38	0	16.8N	84.6E	65	301	15	---	---	---	---	---	
080600Z	15.6N	85.6E	55	16.2N	85.3E	60	77	5	19.2N	86.0E	65	396	35	---	---	---	---	---	
081200Z	17.3N	86.0E	55	16.2N	85.3E	60	77	5	19.2N	86.0E	65	396	35	---	---	---	---	---	
081800Z	19.2N	86.6E	55	16.2N	85.3E	60	77	5	19.2N	86.0E	65	396	35	---	---	---	---	---	
090000Z	20.6N	88.1E	50	21.3N	87.8E	50	45	0	---	---	---	---	---	---	---	---	---	---	
090600Z	22.1N	89.4E	45	21.3N	87.8E	50	45	0	---	---	---	---	---	---	---	---	---	---	
091200Z	23.4N	91.5E	30	23.3N	91.6E	40	8	10	---	---	---	---	---	---	---	---	---	---	

AVERAGE FORECAST ERROR
AVERAGE RIGHT ANGLE ERROR
AVERAGE MAGNITUDE OF WIND ERROR
AVERAGE BIAS OF WIND ERROR
NUMBER OF FORECASTS

ALL FORECASTS
WARNING 24-HR 48-HR 72-HR
52NM 204NM 35NM 0NM
38NM 80NM 110NM 0NM
6KTS 12KTS 15KTS 0KTS
-1KTS 4KTS 15KTS 0KTS
9 7 5 0

APPENDIX

ABBREVIATIONS AND DEFINITIONS

The following abbreviations and definitions apply for the purpose of this report.

1. ABBREVIATIONS

AC&W	Aircraft Control and Warning
AIREPS	Commerical and Military Aircraft Weather Report
AJTWC	Alternate Joint Typhoon Warning Center (Asian Tactical Forecast Center, Fuchu, Japan)
APT	Automatic Picture Transmission
AWN	Automatic Weather Network
CINCPAC	Commander in Chief, Pacific
CINCPACAF	Commander in Chief, Pacific Air Forces
CINCPACFLT	Commander in Chief, Pacific Fleet
CINCUSARPAC	Commander in Chief, U.S. Army Pacific
DAPP	Data Acquisition and Processing Program (Renamed DMSP)
DMSP	Defense Meteorological Satellite Program
ENVPREDRSCHFAC	Environmental Prediction Research Facility (Naval Postgraduate School, Monterey, California)
NESS	National Environmental Satellite Service (Suitland, Maryland)
NWS/NOAA	National Weather Service, National Oceanic and Atmospheric Administration
PACOM	Pacific Command
SLP (MSLP)	Sea Level Pressure (Minimum Sea Level Pressure)
TCRC	Tropical Cyclone Reconnaissance Coordinator
WMO	World Meteorological Organization

2. DEFINITIONS

CYCLONE - An atmospheric closed circulation rotating counterclockwise in the northern hemisphere.

TROPICAL CYCLONE - A non-frontal cyclone of synoptic scale, developing over tropical or sub-tropical waters and having

a definite organized circulation and warm core.

TROPICAL DEPRESSION - A tropical cyclone in which the maximum sustained surface wind is 33 kt or less.

TROPICAL STORM - A tropical cyclone with maximum sustained surface winds in the range 34 to 63 kt inclusive.

TYPHOON/HURRICANE - A tropical cyclone with maximum sustained surface wind speeds 64 kt or greater. West of 180 degrees longitude the name TYPHOON is used and east of 180 degrees longitude the name HURRICANE is used. All descriptive references to typhoons apply equally to hurricanes.

SUPER TYPHOON - A typhoon with maximum sustained winds greater than or equal to 130 kt.

TROPICAL DISTURBANCE - A discrete system of apparently organized convection, generally 100 to 300 miles in diameter, originating in the tropics or sub-tropics, having a non-frontal migratory character and having maintained its identity for 24 hours or more. It may or may not be associated with a detectable perturbation on the wind field. As such, it is the basic generic designation which, in successive stages of intensification, may be subsequently classified as a tropical depression, tropical storm or typhoon.

EYE/CENTER - EYE refers to the roughly circular central area of a well-developed tropical cyclone usually characterized by comparatively light winds and fair weather. If more than half surrounded by wall cloud, the word EYE is used; otherwise, the area is referred to as a CENTER.

WALL CLOUD - A densely organized, roughly circular structure of cumuliform clouds completely or partially surrounding the eye or center of a tropical cyclone.

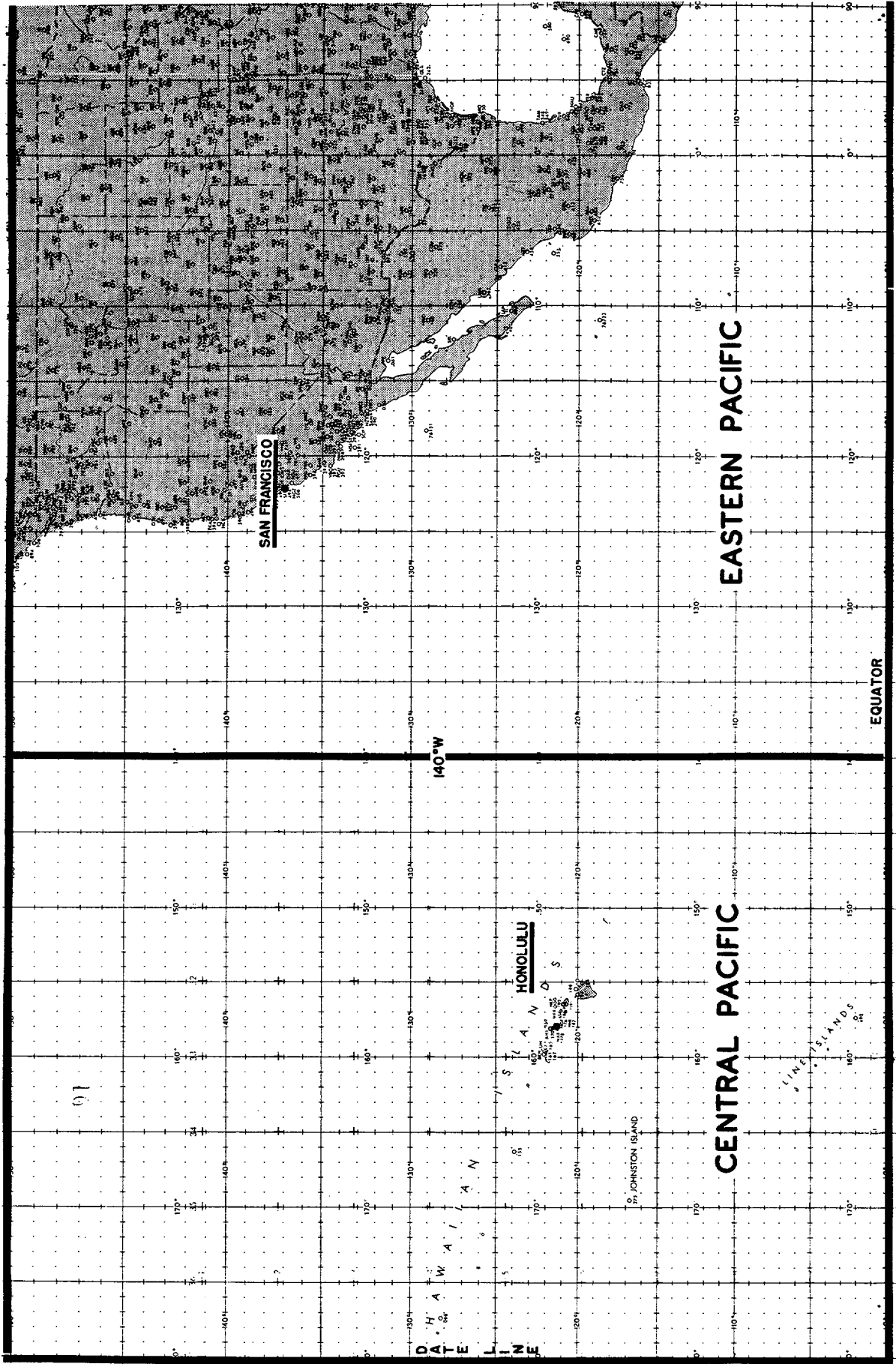
MAXIMUM SUSTAINED WIND - Highest surface wind speed of a cyclone averaged over a one minute period of time.

EXTRATROPICAL - A term used in warnings and tropical summaries to indicate that a cyclone has lost its "tropical characteristics." The term implies both poleward displacement from the tropics and the conversion of the cyclone's dominant energy source from latent heat of condensation release to baroclinic processes.

TROPICAL CYCLONE RECONNAISSANCE COORDINATOR - A CINCPACAF representative designated to levy tropical cyclone weather reconnaissance requirements on CINCPACAF reconnaissance units within a designated area of PACOM and to function as a coordinator between CINCPACAF, weather reconnaissance units, and JTWC.

DISTRIBUTION

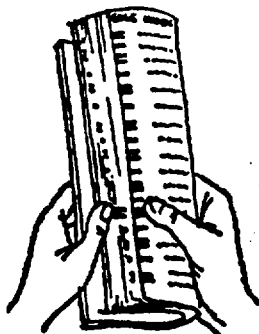
AFGWC (2)	HQ, 1WWG (15)
BUR OF MET, AUST (1)	HQ, 3WWG (1)
AMER EMB BANGKOK (1)	HQ, 9WRWG (2)
CATH UNIV OF AMERICA (1)	INDIA MET DEPT (1)
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COLORADO STATE UNIV (LIBR) (1)	NAVAL ACADEMY (1)
COLORADO STATE UNIV (MET) (1)	NAVOCEANO (2)
COMCRUDESAC (1)	NAVPGSCOL (DEPT OF MET) (2)
COMINFLOT ONE (1)	NAVPGSCOL (LIBRARY) (1)
COMNAVAFACENGCOMPACDIV (1)	NAVWEASERFAC ALAMEDA (1)
COMNAVMARIANAS (1)	NAVWEASERFAC JACKSONVILLE (1)
COMNAVWEASERVCOM (10)	NAVWEASERFAC SAN DIEGO (1)
COMPHIBPAC (1)	NESS (2)
COMSEVENTHFLT (1)	NHRL (2)
COMUSTDC (1)	NHC (2)
CPF (1)	NWSED ASHEVILLE (2)
CSG (1)	NWSED ATSUGI (1)
CLSF (1)	NWSED BARBERS POINT (1)
CSSF (1)	NWSED CUBI POINT (1)
CAF (1)	NWSED IWAKUNI (1)
CACSF (1)	NWSED NAHA (1)
CASWF THREE (1)	NWSED YOKOSUKA (1)
CGFMF (1)	ODDR&E (1)
COMSC (1)	OKINAWA MET OBS (1)
COMTHIRDFLT (1)	OL A, 10WSQ (1)
COMUSNAVFORJAPAN (1)	OL B, 1WWG (4)
COMUSNAVPHIL (1)	PAGASA (3)
DDC (10)	ROYAL OBSERVATORY (3)
DIA (1)	TEXAS A&M (1)
DIR OF MET SAIGON (1)	TYPHOON COMM SECR (1)
ECAFE (2)	TTPI (1)
EDS (DS4) (1)	UNIV OF GUAM (1)
8 AF/DOO (1)	UNIV OF HAWAII (DEPT OF MET) (2)
ENVPREDRSCHFAC (4)	UNIV OF HAWAII (LIBR) (1)
FAA (CERAP) (2)	UNIV OF MEXICO (1)
FLENEMWEACEN (1)	UNIV OF PI (1)
FLEWEACEN NORFOLK (1)	VQ-1 (1)
FLEWEACEN PEARL HARBOR (1)	WEARECONRON FOUR (1)
FLEWEACEN ROTA (1)	20WSQ (11)
FLEWEAFAC SUITLAND (1)	53WRS (2)
GEN MET DEPT THAILAND (1)	54WRS (10)
HQ AWS (3)	55WRS (2)
HQ, 1ST MARINE ACFT WG (1)	3345TH TECH SCHOOL (1)



Areas of Responsibility - Central and Eastern Pacific Hurricane Centers

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Match up the 1 or 2 line symbol next to the listing you have selected with the corresponding 1 or 2 dot symbol on the page edge.

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CHAPTER II Reconnaissance and Communication

CHAPTER III Research Summary

CHAPTER IV Summary of Tropical Cyclones

CHAPTER V Summary of Forecast Verification Data

ANNEX A Summary of Tropical Cyclones in the Central North Pacific

ANNEX B Bay of Bengal Tropical Cyclones

APPENDIX Abbreviations, Definitions and Distribution